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Mixed Waste Focus Area
Department of Energy Complex Needs Report

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Foreword

The Assistant Secretary for the Office of Environmental Management (EM) at the United States Department of Energy (DOE) initiated a new approach in August of 1993 to environmental research and technology development. A key feature of this new approach included establishment of the Mixed Waste Characterization, Treatment, and Disposal Focus Area (MWFA). The mission of the MWFA is to identify, develop, and implement needed technologies such that the major environmental management problems related to meeting DOE's commitments for treatment of mixed wastes under the Federal Facility Compliance Act (FFCA), and in accordance with the Land Disposal Restrictions (LDR) of the Resource Conservation and Recovery Act (RCRA), can be addressed, while cost-effectively expending the funding resources. To define the deficiencies or needs of the EM customers, the MWFA analyzed Proposed Site Treatment Plans (PSTPs), as well as other applicable documents, and conducted site visits throughout the summer of 1995. Representatives from the Office of Waste Management (EM-30), the Office of Environmental Restoration (EM-40), and the Office of Facility Transition and Management (EM-60) at each site visited were requested to consult with the Focus Area to collaboratively define their technology needs. This report documents the needs, deficiencies, technology gaps, and opportunities for expedited treatment activities that were identified during the site visit process. The defined deficiencies and needs are categorized by waste type, namely Wastewaters, Combustible Organics, Sludges/Soils, Debris/Solids, and Unique Wastes, and will be prioritized based on the relative affect the deficiency has on the DOE Complex.

CONTENTS

CONTENTS (continued)

FIGURES

TABLES

ACRONYMS

ANL-W	Argonne National Laboratory - West
AWU	Associated Western University
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMST-CP	Characterization, Monitoring, and Sensor Technology Crosscutting Program
CRU	CERCLA/RCRA Unit
DF&O	Director's Findings and Order
DOE	U.S. Department of Energy
DOE-AL	U.S. Department of Energy-Albuquerque Operations Office
DOT	U.S. Department of Transportation
EM	Environmental Management
EPA	Environmental Protection Agency
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Act
IAG	Interagency Agreement
INEL	Idaho National Engineering Laboratory
LANL	Los Alamos National Laboratory
LDR	Land Disposal Restrictions
LFA	Landfill Focus Area
LMESAT	Lockheed Martin Environmental Systems and Technology
MAWS	minimum additive wastes
METC	Morgantown Energy Technology Center
MLLW	mixed low-level waste
MTU	Mobile Treatment Unit
MWFA	Mixed Waste Characterization, Treatment, and Disposal Focus Area
NMED	New Mexico Environmental Department
ORR	Oak Ridge Reservation
PBR/SDP	Packed Bed Reactor/Silent Discharge Plasma
PCB	polychlorinated biphenyl
PHP	Plasma hearth process
PNL	Pacific Northwest Laboratories
Pu	Plutonium
PWTU	Portable Water Treatment Unit
RCP	Robotics Crosscutting Program
RCRA	Resource Conservation and Recovery Act
RFETS	Rocky Flats Environmental Technology Site
RFP	request for proposal
RI/FS	Remedial Investigation/Feasibility Study
Rust	Rust Federal Services, Inc.
SAIC	Science Applications International Corporation
SEG	Scientific Ecology Group
SRS	Savannah River Site

ACRONYMS (continued)

STAR	Scientific and Technology Applications Research
STP	Site Treatment Plan
TOC	total organic content
TPM	Technical Program Manager
TPO	Technical Program Officer
TRT	Technical Resource Team
TSCA	Toxic Substance Control Act
TSS	total suspended solids
TST	Technical Support Team
TTP	technical task plan
WIPP	Waste Isolation Pilot Plant
WTM	Waste Type Manager

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1. INTRODUCTION

The Assistant Secretary for the Office of Environmental Management (EM) at the United States Department of Energy (DOE) initiated a new approach in August of 1993 to environmental research and technology development[1]. The key features of this new approach included establishment of five "focus areas" and three "crosscutting" technology programs, which overlap the boundaries of the focus areas. The five focus areas include the Contaminant Plumes Containment and Remediation; Mixed Waste Characterization, Treatment, and Disposal; High-Level Waste Tank Remediation, Landfill Stabilization, and Decontamination and Decommissioning Focus Areas. The three crosscutting technologies programs include Characterization, Monitoring, and Sensor Technology; Efficient Separations and Processing, and Robotics. In addition, an Industrial Programs group was established as part of this new approach, that serves all of the focus areas and crosscutting technologies programs. The major characteristic of the new approach is that aggressive teaming with the customers within EM, through the focus areas, is used to identify, develop, and implement needed technologies such that the major environmental management problems can be addressed, while cost-effectively expending the funding resources.

1.1 Approach of the Mixed Waste Focus Area

The DOE created the Mixed Waste Characterization, Treatment, and Disposal Focus Area (MWFA) to develop and facilitate implementation of technologies required to meet its commitments for treatment of mixed wastes under the Federal Facility Compliance Act (FFCA), and in accordance with the Land Disposal Restrictions (LDR) of the Resource Conservation and Recovery Act (RCRA). This includes mixed low-level wastes (MLLW) and mixed transuranic (MTRU) wastes. Mixed low-level waste are defined as wastes that contain both hazardous constituents, as identified by RCRA, and radioactive constituents, including alpha-emitting radionuclides below concentrations of 100 nanoCuries per gram. Mixed transuranic wastes contain RCRA contaminants and radioactive contaminants, including alpha-emitting radionuclides with concentrations above 100 nanoCuries per gram.

To accomplish this goal, a technical baseline must be established, deficiencies in required technologies must be identified, and design requirements must be developed based on these needs. The identified requirements must then be integrated into the planned and ongoing environmental research and technology development activities supported by the MWFA.

1.1.1 Needs Identification and Categorization Process

To define the deficiencies or needs of the EM customers, the MWFA analyzed Proposed Site Treatment Plans[2] (PSTPs), the *1995 Report of Hanford Site Land Disposal Restrictions for Mixed Waste*, April 1995 (DOE/RL-95-15)[3], as well as other applicable documents, and conducted site visits throughout the summer of 1995. Representatives from the Office of Waste Management (EM-30), the Office of Environmental

Restoration (EM-40), and the Office of Facility Transition and Management (EM-60) at each site visited were requested to consult with the Focus Area to collaboratively define their technology needs. Personnel from these programs participated in the MWFA site visit as deemed appropriate by the respective sites. The needs identified during the site visits were categorized by waste type, namely Wastewaters, Combustible Organics, Sludges/Soils, Debris/Solids, and Unique Wastes.
These waste types are defined as follows:

Wastewater waste streams, which comprise approximately 3% of the total DOE Complex mixed waste inventory, include liquids and slurries. Slurries are defined as liquids with a total suspended solids (TSS) content greater than 1% and less than 30%. Liquids and slurries defined as Waste Waters contain less than 1% total organic carbon (TOC).

Combustible Organic waste streams, which comprise approximately 1.5% of the total DOE Complex mixed waste inventory, include liquids and slurries containing greater than 1% TOC, and solids with a base structure that is primarily organic such that a maximum of approximately 20% by weight would remain as residue following incineration. Solids are defined, including sludges, as having greater than 30% TSS.

Homogeneous Solids/Sludges/Soil waste streams, which comprise approximately 48% of the total DOE Complex mixed waste inventory, include waste that is at least 50% by volume inorganic sludges, including water content. Sludges are defined as having a TSS greater than 30%. A sludge may be a mixture with a stabilization agent that has not properly solidified, or may be a mixture with absorbent materials. This category also includes inorganic particulate, paint waste, and salt waste.

Debris/Solid waste streams, which comprise approximately 46% of the total DOE Complex mixed waste inventory, include waste that is at least 50% by volume materials that meet the EPA LDR criteria for classification as debris (…"material exceeding a 60 mm particle size that is intended for disposal…") This category also includes waste that is estimated to be 50% by volume soil, including sand or silt, rock, or gravel which does not meet the EPA LDR criteria for debris.

Unique Wastes, which comprise approximately 1.5% of the total DOE Complex mixed waste inventory, generally include low volume waste streams such as elemental heavy metals, batteries, reactive metals, explosives, compressed gases, lab packs, and other miscellaneous wastes that present unique treatment problems and are not included in the previously defined categories. It also includes the Final Waste Form and Unknown/Other category wastes [Z and U series waste streams identified in the *DOE Waste Treatability Group Guidance*[4] document, (DOE/LLW-217), January 1995].

1.1.2 Waste Type Manager Selection Process

During the site visit process, the MWFA initiated an effort to identify individuals with a strong background in each waste type, to provide leadership in managing the waste streams in each waste category. These individuals serve as a necessary resource to ensure that the identified needs, as related to the established technical baseline, are met such that the waste types can be brought into compliance with the applicable regulations.

Waste Type Managers (WTMs) were selected from experienced leaders, proposed by the sites in the DOE Complex, through an open nomination process. The WTMs will use a systems analysis approach to develop the technical baseline that the MWFA will implement to meet the identified DOE complex mixed waste needs. Table 1.1 lists the WTMs for each waste type.

Although the MWFA is an EM-50 program, the customers are EM-30 (primarily), EM-40, and EM-60 organizations throughout the DOE Complex. As previously stated, the mission of the Focus Area is to identify, develop, and implement technologies needed by the EM customers to allow treatment of the DOE mixed waste inventory. For this reason, the MWFA desired to identify lead individuals for each waste type with a broad experience base in the waste type, and an EM-30 or 40 background. The insight, complex-wide contacts, and knowledge that these individuals can provide are crucial if the Focus Area is to effectively address and resolve the customers needs.

As shown in Table 1.1, above, the WTMs have been selected from many different sites in the DOE Complex. In every case, the primary WTM selected has come from an EM-30 environment. In *almost* every case, the individual chosen to be the WTM for a given waste type is employed at the site that has the largest inventory of that waste type.

1.1.3 Purpose of the Site Visit Process

The site visits had several specific purposes: 1) to identify the technology development needs for managing mixed wastes at the DOE sites; 2) to understand the regulatory status/situation at the sites; 3) to status the technology transfer and other privatization efforts at the sites; 4) to identify completed, ongoing, and planned technology development work being conducted by EM-30, 40, 50, and 60 at the sites; and 5) to identify potential matches between current capabilities and defined site technology needs (referred to hereafter as "quick wins"). The success of the MWFA in accomplishing these goals is discussed in

Table 1.1 Waste Type Managers

Waste Type	Waste Type Manager	DOE Site	Phone
Waste Waters	Cliff Brown	Rocky Flats (outplant from Oak Ridge)	303-966-3667
Combustible Organics	Leon Borduin	Los Alamos National Laboratory	505-667-3150
	Dave Hutchins (DOE)	Oak Ridge	615-241-6420
Sludges/Soils	Scott Anderson	Rocky Flats	303-966-3578
Debris/Solids	Mike Connolly	Idaho National Engineering Laboratory	208-526-0238
	James Blankenhorn	Savannah River	803-952-3722
Unique Wastes	Ron Nakaoka	Los Alamos National Laboratory	505-665-5971

Section 1.2. The details of the site visit process are described in Section 2. The technology gaps, deficiencies, and other needs identified during the site visits are documented and discussed in Section 3, and the potential quick wins are listed in Section 4.

1.2 Effectiveness for the Mixed Waste Focus Area

The site visits were very successful for the MWFA. Meeting with the EM-30, 40, 50, and 60 representatives from seven major DOE sites provided invaluable insight into the technology development needs, status of ongoing work, and DOE and contractor organizational relationships and structure at the sites. Substantial information was gathered related to the mixed waste needs for the DOE complex. In addition, several potential quick wins were identified for evaluation by the MWFA and the applicable sites and potential implementation. Other useful data was collected that will help the MWFA better understand the mechanisms required to effectively integrate with the individual sites.

A set of standard questions, which has been included as Addendum A of this report, were developed to help ensure that the desired data was obtained from the sites. For the majority of the sites visited by the Focus Area, answers to all of the standard questions were adequately provided. However, the primary area of focus during the site visits was identifying the technology development needs related to managing the DOE Complex mixed wastes. Consequently, due to time constraints, the data collected for some of the sites in the other areas mentioned is only partially complete. Specifically, the area for which the MWFA lacks information is related to previously completed treatability studies and demonstrations. The Focus Area will continue to gather this information, as required, while using the available data to develop a technical baseline for management of the DOE complex mixed wastes.

2. SITE VISIT PROCESS

The MWFA completed visits to seven of the major sites in the DOE Complex between May 1995 and August 1995. These site visits were relatively effective in collecting the data that the MWFA was seeking. The following subsections identify the sites visited, document the schedule and site contacts, discuss the specific and overriding purposes, and describe the process incorporated in collecting and disseminating the information to support development of a technical baseline for the MWFA.

The term “technical baseline” refers to the strategic plan that the MWFA will establish to resolve the needs identified by the DOE Complex during the site visit process. The technical baseline will consist of a set of technology development activities supported by the Focus Area that address the highest priority deficiencies related to management of the mixed waste inventory in the DOE Complex. Every activity included in the MWFA technical baseline will directly address a prioritized need, deficiency, or technology gap identified by the DOE EM customers. The process used to evaluate and prioritize the Complex needs will be developed and approved by the WTMs, with support from the Technical Resource Team (TRT). (The TRT is a multidisciplinary team of recognized DOE, industry, and academia experts, assembled by the MWFA, that provide technical evaluations and other support functions to the WTMs.)

2.1 Site Selection, Schedule, and Site Contacts

The MWFA began development of the site visit process by, first, determining the sites that should be addressed, next, developing a schedule for the proposed site visits, and then, finalizing a coordinated schedule with the target sites. The MWFA "site visits" were completed by two different mechanisms. The initial effort, which occurred at the Idaho National Engineering Laboratory (INEL), was accomplished through several small meetings with individual DOE and contractor representatives from EM-30, 40, and EM-60. This mechanism did not allow the productive interaction that occurs between individuals with different backgrounds and expertise in a group setting. Accordingly, the follow-on visits to the other DOE sites were set up such that EM-30, 40, and 60 customers (as determined by the individual sites), as well as EM-50 representatives, attended together. This provided joint participation by the applicable customers with the Focus Area to identify site technology development needs, status ongoing technology development activities, and define site technology development/demonstration capabilities.

2.1.1 Site Selection and Schedule

The primary criteria for selecting the sites that the Focus Area would visit was the volume of mixed waste at the site. The data provided in the PSTPs, generated by the individual DOE sites, was analyzed according to waste type to determine the three sites that have the largest volumetric inventory for each category. The waste type categories, as previously defined, include Waste Waters, Combustible Organics, Debris/Solids, Sludges/Soils, and Unique Wastes. These waste categories are further defined in Attachment 1 of Christine Bonzon letter to Distribution, *Development and Implementation of Mixed Waste Focus Area Program* (OPE-R&D-95-427), May 23, 1995[5]. As a result of this analysis, the following DOE facilities were identified for site visits: the INEL, Savannah River Site (SRS), Hanford Reservation (Hanford), Oak Ridge Reservation (ORR), Ohio Sites (Ohio), Rocky Flats Environmental Technology Site (RFETS), and Albuquerque Sites (AL). The data generated for this evaluation has been included in Table 2.1 for reference.

2.1.2 Site Contacts

After the Focus Area determined the sites that would be visited, a primary contact was established for each site. These contacts were solicited via a letter sent to the Technical Program Officers (TPOs) and Technical Program Managers (TPMs) at each of the sites identified to be visited by the Focus Area. This letter, Christine Bonzon letter to Distribution, *Mixed Waste Focus Area Key 1995 Activities and Request for Identification of EM Points-of-Contact* (OPE-R&D-95-426), May 23, 1995[6], was responded to by all the affected sites. The initial site contacts identified, as well as additional primary contacts for each site are listed in Table 2.2.

After the MWFA meetings were completed at the INEL, visits were scheduled for each of the identified sites through the contacts provided. The following is the final schedule for those site visits, after some interim revisions.

Savannah River	June 7-9, 1995	Ohio	July 13-14, 1995

Hanford	June 21-22, 1995	Rocky Flats	August 29-30, 1995
Oak Ridge	August 22-23, 1995	Albuquerque	August 1 - 3, 1995

As previously discussed, the MWFA utilized several separate meetings to gather the information related to the INEL technology development needs. Consequently, the INEL "visit" continued throughout the month of May 1995.

As seen in Table 2.1, the only site that appears on this list that was not visited by the MWFA is the Portsmouth Gaseous Diffusion Plant at Piketon, OH. Although the Focus Area did not actually visit this facility, information was received during the Ohio (Fernald) site visit, because the personnel at these facilities have been working together to address similar problems. In addition, during the Oak Ridge

Table 2.1 Sites with the Top Three Largest Volume Inventories in the MWFA Waste Types

Waste Type	Mixed Transuranic Waste Inventory		Mixed Low-Level Waste Inventory		Total Inventory	
	Site	Vol (m^3)	Site	Vol (m^3)	Site	Vol (m^3)
Waste Waters	Rocky Flats	23	Oak Ridge	3381	Oak Ridge	3381
			Ohio - Fernald	2194	Ohio - Fernald	2194
			Rocky Flats	533	Rocky Flats	556
Combustible Organics	INEL	5	Oak Ridge	1639	Oak Ridge	1639
	Rocky Flats	5	Ohio - Fernald	584	Ohio - Fernald	584
			Portsmouth	480	Portsmouth	480
Debris/Solids	INEL	32252	INEL	20790	INEL	53042
	SRS	9880	Portsmouth	4003	SRS	15501
	Oak Ridge	1748	SRS	5621	Portsmouth	4003
Sludges/Soils	INEL	6881	Oak Ridge	34963	Oak Ridge	36369
	Los Alamos	2575	Rocky Flats	11169	Rocky Flats	11169
	Oak Ridge	1406	INEL	3935	INEL	10816
Unique Wastes	Los Alamos	4886	INEL	687	Los Alamos	5325
	Argonne-West	14	Los Alamos	439	INEL	698
	INEL	11	Hanford	368	Hanford	368

Table 2.2 Site Contacts for MWFA Visits

Site	Contact	Organization	Telephone
Albuquerque	Karen Douglas	DOE-AL STCG Chair	505-845-6411
	Jim Orban	DOE-AL STCG	505-845-4421
	Joel Grimm	DOE-AL	505-845-5463
Hanford Reservation	Joe Waring	DOE-RL STCG	509-373-7687
	Shannon Runyon	DOE-RL EM-50 STCG	509-372-4029
INEL	Joel Case	DOE-ID EM-30 STCG	208-526-6795
	Lisa Green	DOE-ID EM-40	208-526-0417
	Alice Williams	DOE-ID EM-60	208-526-0972
Oak Ridge Reservation	Dave Hutchins	DOE-ORO	615-241-6420
	Jan Berry	LMES Tech. Dev.	615-574-6907
Ohio - Fernald	John Murphy	DOE-OFO	513-865-3689
	John Sattler	DOE-FN	513-648-3145
Rocky Flats Environmental Technology Site	Russell McCallister	DOE-RFFO TPO	303-966-9692
	Gary Semones	Kaiser-Hill Tech. Int.	303-966-3044
Savannah River Site	Howard Pope	DOE-SR	803-725-5544
	Harold Sturm	WSRT TPM	803-725-3497

Reservation visit, substantial information was received relative to the typical mixed waste streams associated with gaseous diffusion plants. Based on these premises, the MWFA has effectively addressed the technology needs for approximately 82% of the DOE complex mixed waste inventory.

2.2 Site Visit Process

The specific purposes of the site visits were listed in the introduction of this report. These included: 1) identify the technology development needs for managing mixed wastes at the DOE sites; 2) understand the regulatory status/situation at the sites; 3) status the technology transfer and other privatization efforts at the sites; 4) identify completed, ongoing, and planned technology development work being conducted by DOE EM-30, 40, 50, and 60; and 5) identify potential quick wins. This information was gathered to support the primary objective of the MWFA: to incorporate a systems analysis approach in developing an integrated strategy, or technical baseline, for directing mixed waste related technology development activities that will ensure that the EM-30, 40, and 60 customer needs are being met, and that the MWFA program is operating as cost-effectively as possible, while reducing the non-RCRA compliant DOE mixed waste inventory as quickly as practical.

The site visit process is a key element in establishing the framework and defining the specific requirements

that must be scheduled and tracked to successfully implement the technical baseline. For this reason, the site visit process was carefully developed to ensure 1) that effective communications are established between the MWFA and the sites, 2) that the required information is obtained from the sites, 3) that the data gathered is well documented and concurred with by the customers, and 4) that a flexible system involving traditional technology development as related to the identified needs, as well as potential quick wins, is being cost-effectively used to support the primary objective of the MWFA.

The Site Visit Process is depicted in Figure 2.1. As shown in this figure, the key elements of the site visit process are 1) initial needs assessment, 2) the MWFA site visit, 3) a trip report documenting the needs and potential quick wins, and 4) a final compilation of the complex needs and quick win data collected. Each of these steps is described in more detail below.

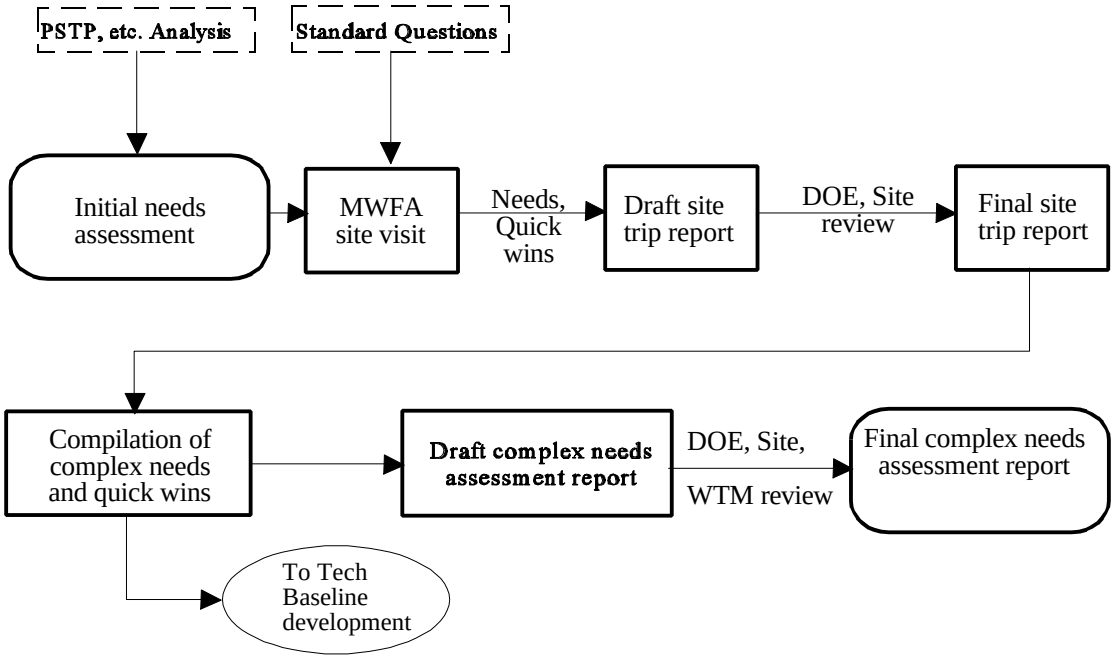
Prior to each site visit, MWFA support personnel, primarily the TRT, reviewed the PSTPs and other applicable documents that were available to develop an initial assessment of the site's technology development needs. In most cases, this initial assessment was issued to the sites approximately two weeks before the MWFA personnel arrived for the site visit. The purposes for doing this were to provide a starting point for discussions pertaining to the site technology development needs, and to gain feedback to determine how accurate the MWFA perception of the site specific situation was. The needs assessments were transmitted to the sites as attachments to the Site Visit letters[7 - 13], which announced the dates and agenda for the MWFA visits.

During the MWFA site visits, answers to specific questions related to the sites' needs, capabilities, and program status were sought. These questions, referred to as "Standard Questions for Site Visits", were developed prior to the site visits. The purpose of identifying these standard questions was to ensure that the data required to establish a defensible technical baseline was collected to the greatest extent practical. These questions also greatly enhanced the productivity and efficiency of the MWFA visits. As previously stated, a copy of the Standard Questions for Site Visits has been included in Addendum A for reference.

Upon completion of each site visit, a trip report was generated that documented the information that the MWFA had gathered. These reports, which were generally completed within a few weeks of the site visit, include the identified priority needs, potential quick wins, and status of the technology development activities at that site. Trip reports have been completed and transmitted back to all the sites visited by the MWFA for review, comment, and finalization. Each trip report transmittal letter[14 - 20] includes a requested date for comments to be returned to the MWFA. All comments received have been incorporated in the individual trip reports and in the data included in this document, as applicable. Trip reports for which comments were not received were assumed acceptable to the applicable site. The site specific trip reports have been included in Addendum B for reference. In some cases, supporting documentation included in the appendices of the original reports has been omitted for brevity, but all pertinent information has been included. *(If complete copies of the site visit trip reports or additional information is desired, please contact Jay Roach at 208-526-4974.)*

The information contained in the trip reports and the initial needs assessments will be incorporated into the technical baseline. Some needs will define specific technology gaps in the treatment systems identified for the waste types, while others will be general system needs. The technology development needs and

Figure 2.1 Site Visit Process Diagram



potential quick wins compiled in this report provide the customer defined justification for the technical baseline. One of the most important aspects of the entire site visit process is close coordination with the EM-30, 40, and 60 customers in identifying their priority needs and concerns. Dissemination of the data collected into the technical baseline is critical in providing an integrated systems approach to addressing the needs of the MWFA customers. Accordingly, the technical baseline, which will be managed by the WTMs and their support teams, will be evaluated semi-annually, and the supporting projects will be reviewed quarterly to ensure that the EM-30, 40, and 60 priority needs are being met in the most timely and cost-effective manner.

3. IDENTIFIED TECHNOLOGY DEVELOPMENT NEEDS FOR THE DOE COMPLEX

This section discusses the specific technology, regulatory, and programmatic needs identified during the site visits and in the PSTPs. These needs have been primarily differentiated as general needs and needs that are waste type specific. Within the general needs category, further segregation has been made between needs related to characterization, emissions monitoring, container waste handling, and programmatic issues. Within the waste type specific needs category, further segregation has been made between the five waste types. Within each waste type, the needs have been categorized as either complex wide or site specific

Some of these needs may have already been identified for resolution by other focus areas and/or crosscutting programs, or would be more appropriately addressed by one of these other programs. Transfer of applicable needs and technology gaps will be coordinated with other appropriate focus areas

and crosscutting programs, as necessary. The specific needs collected during the site visits, which are listed below, will be prioritized for inclusion in the technical baseline by the WTMs.

3.1 General Needs - Not Waste Type Specific

This section contains the needs identified in the site visits that are not specific to a particular waste type. These include waste characterization, emissions monitoring, container integrity, treatment systems, and programmatic issues.

3.1.1 Waste Characterization Needs

These needs should be coordinated with the Landfill Focus Area (LFA), the Characterization, Monitors, and Sensor Technology Crosscutting Program (CMST-CP), and the Robotics Crosscutting Program (RCP) as appropriate.

3.1.1.1 A complex wide need exists for nondestructive examination and analysis of containerized mixed low-level waste (MLLW) and MTRU waste. The need exists for combustibles, radionuclides, and RCRA metals, as well as free liquids, and compressed gases. To reduce radiation exposure to workers the examination and analysis should be performed remotely.

3.1.1.2 The need exists for the capability to vent containers for gas sampling while maintaining containment and minimizing personnel exposure, which may require a mobile unit. This may be a potential alternative to NDE/NDA. The configuration should be flexible to allow access to vaults and similar hard-to-reach areas, which are typical of remote handled waste storage locations.

3.1.1.3 A need exists for real time analysis of waste either in containers or in an appropriate transport system such as a conveyor. This would include differentiating between alpha-LLW and TRU waste at SRS and ID. Ohio has identified the need for a real-time radon monitor.

3.1.2 Container Integrity and Refurbishment Needs

These needs should be coordinated with the LFA and the RCP as appropriate.

3.1.2.1 A need exists to nondestructively assess container integrity and internal pressure without opening.

3.1.2.2 A need exists for moisture restrictive drum venting filters that will allow drums to be vented while preventing moisture from entering the drum. This will prevent condensate formation in the drums and reduce corrosion.

3.1.2.3 A need exists for a drum refurbishment system that can repair suspect waste drums to Department of Transportation (DOT) Type A requirements. This would increase the life of

the drums, reduce overpacking, reduce costs, and reduce worker exposure.

3.1.2.4 For containers that cannot be refurbished, a need exists for a corrosion-proof container and overpack system that will be in long term (50 years) storage. The container and overpack system should meet DOT standards, as well as provide long term resistance to corrosion and degradation from external and internal environments, including high radioactivity.

3.1.2.5 INEL has a need for a DOT approved box transport system for MTRU waste boxes. The required design, development, and DOT testing must be completed as part of the scope of this effort. MWFA support for this effort would have to be coordinated with the National TRU Program.

3.1.2.6 Much of the SR mixed-TRU waste is contaminated with Pu^{238} at levels 10 to 100 times greater than that allowed in TRUPACT II containers. Meeting the shipping limits requires blending this material with other materials/wastes to dilute the plutonium, which generated huge waste volumes for shipping to Waste Isolation Pilot Plant (WIPP). Efforts need to be directed toward development of an approved stabilization/packaging process that does not require dilution to meet shipping limits. In addition, the possibility of changing the regulations governing TRUPACT II containers should be pursued.

3.1.3 Waste Handling Needs

These needs should be coordinated with the RCP as appropriate.

3.1.3.1 A need exists for effective robotic waste handling capabilities for both front end and back end handling in treatment systems being developed by DOE (plasma hearth, joule-heated vitrification, etc).

3.1.3.2 A need exists for improved sorting and segregation techniques for containerized wastes to minimize personnel exposure.

3.1.4 Treatment Systems Needs

These needs are generally complex wide needs associated with treatment systems being developed, or for unique treatment systems.

3.1.4.1 A need exists for coordination in treatment demonstrations, such that surrogate and actual waste streams chosen for demonstration yield data that is as widely applicable across the DOE complex as possible and support planned treatment facilities.

3.1.4.2 A need exists to demonstrate and deploy small low-cost stationary or mobile systems with the capability to process small volume waste streams including: organic liquids, paints, graphite, lead, mercury, plastics, debris, sludges, soil, inorganic salts/fines, and pressurized cans (this need identified by Ohio). This need will address waste at the many sites that have specific

small waste streams. Potential unit operations include, but are not limited to:

- Segregation/Shredding/Screening
- Stabilization/Macroencapsulation
- Macroencapsulation
- Debris Washing
- Organic Removal and Destruction
- Neutralization/Precipitation/Filtration

3.1.4.3 A need exists to conduct comparative evaluation testing and component integration to develop a robust offgas system capable of removing particulates and volatile radioactive/hazardous metals, as well as NOx, and SOx, while minimizing secondary waste generation and PIC formation. The system should include all necessary continuous emissions monitoring equipment and the system developed must improve permitting capabilities for DOE treatment systems.

3.1.5 Programmatic Needs

These needs are generally not technical needs, but administrative needs that have been identified by the MWFA and site personnel to enhance the effectiveness of the Focus Area.

3.1.5.1 A need exists to develop a regulatory strategy to support petitions and variances required to deploy non-BDAT treatment for all waste streams, but especially those containing organic contaminants.

3.1.5.2 A need exists to introduce innovative contracting reform to entice commercial vendors to develop treatment capabilities that can address DOE mixed waste streams. This is especially important considering the many privatization efforts underway in the complex.

3.1.5.3 A need exists for the MWFA to produce fact sheets on technologies to describe current status, applicability, operating limits, and life-cycle costs. This should include not only technologies being developed within the MWFA, but other DOE and private-sector development as well.

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3.2 Waste Type Specific Needs

This section contains the needs identified in the site visits that are specific to a particular waste type. The categories include Wastewaters, Combustible Organics, Homogeneous Solids/Sludges/Soils, Debris/Solids, and Unique Wastes; which have general and site-specific needs sections.

3.2.1 Waste Waters

The needs in this section are specifically applicable to the mixed waste identified as waste waters.

3.2.1.1 General Needs. The needs listed in this section are generally applicable complex-wide.

3.2.1.1.1 Conduct comparative evaluation testing among leading technologies for removal and/or

destruction of organic constituents in waste waters to select technologies most applicable to DOE requirements. One or two waste streams will be used to generate comparable data for all processes to be considered. The data set will be collaboratively designed with end-users to support evaluation.

3.2.1.2 Site Specific Needs. This section includes site specific needs identified during the site visits. In some cases, the same need was identified by multiple sites.

3.2.1.2.1 DOE-AL identified a need for neutralization, precipitation, and stabilization for waste waters contaminated with corrosives, heavy metals, and barium.

3.2.1.2.2 Ohio has a need to demonstrate commercial and/or mobile treatment units for organic and metal removal and destruction/stabilization to meet LDR requirements.

3.2.1.2.3 DOE-AL and ORR have identified a need for separation of nickel and other metals from electroplating solutions and vitrification wastes.

3.2.1.2.4 ORR has a need for separation technology for photographic wastes.

3.2.1.2.5 INEL has a need to remove up to 32,000 ppm TCE, 2240pCi/l Cs-137, 640 pCi/l Sr-90, as well as trace DCE, vinyl chloride, chromium, and U to meet drinking water standards while minimizing secondary wastes.

3.2.1.2.6 SRS has a small waste stream (SR-W031) that requires separation/stabilization of chromium/uranium solution and sludge.

3.2.1.2.7 ORR needs improved separation of RCRA and radioactive metals, nitrates, and lithium from waste waters; improved monitoring of RCRA metals in discharge water; and potential stabilization of the residuals.

3.2.2 Combustible Organics

The needs in this section are specifically applicable to the mixed waste identified as Combustible Organics.

3.2.2.1 General Needs. The needs listed in this section are generally applicable complex-wide.

3.2.2.1.1 Off-gas development should be focused to demonstrate one design to capture radionuclides and metals while minimizing emission volume, secondary wastes, and potential for formation of PICs.

3.2.2.1.2 The MWFA should conduct comparative evaluation testing among leading nonthermal stabilization technologies, including polymer encapsulation, cementation, epoxy resins, etc., to determine the best media for encapsulation of ash from the Toxic Substance Control Act

(TSCA) incinerator (this need was identified by Oak Ridge, but is considered a general need for the DOE complex).

3.2.2.2 Site Specific Needs. This section includes site specific needs identified during the site visits. In some cases, the same need was identified by multiple sites.

3.2.2.2.1 DOE-AL, Ohio, and ORR have all identified a need for commercial and/or mobile treatment units to process miscellaneous small volume radioactively contaminated organic waste streams to meet LDR standards.

3.2.2.2.2 DOE-AL has a need to treat high activity organic waste streams.

3.2.2.2.3 DOE-AL and the INEL have a need to treat polychlorinated biphenyl (PCB) contaminated waste. It is likely that other sites also have this need, though none specifically stated so.

3.2.2.2.4 Ohio, ORR, and INEL stated a need for reusable HEPA filters, including data on life-cycle costs. This technology would likely help other sites as well.

3.2.2.2.5 SRS needs to treat tritiated oil contaminated with mercury to meet LDR. They also need a method to quantify the level of mercury contamination.

3.2.2.2.6 SRS has a stream consisting of thenoyl trifluoroacetone, a homogenous, xylene based liquid chelating agent that must be treated to extract TRU contamination and treat the organic remainder to meet LDRs.

3.2.2.2.7 SRS needs technology to remove/destroy organic contamination in matrix to eliminate potential hydrogen generation.

3.2.3 Homogeneous Solids/Soils/Sludges

The needs in this section are specifically applicable to the mixed waste identified as Soils/Sludges.

3.2.3.1 General Needs. The needs listed in this section are generally applicable complex-wide.

3.2.3.1.1 A general need exists for commercial and/or mobile microencapsulation or stabilization capability for LDR compliant treatment of wastes including; precipitated metal sludges at Albuquerque sites; soils, salts, sludges, finely divided solids containing RCRA toxic and pyrophoric metals at Ohio sites; soils, wastewater treatment sludges, incinerator ash, and nitrate/chloride salts at Oak Ridge sites.

3.2.3.1.2 A need exists for comparative evaluation testing among leading processes for immobilization of sludges/soils to determine which technologies are most applicable to DOE mixed wastes. Technologies should include vitrification, cementation, and polymer encapsulation.

3.2.3.1.3 A need exists for more durable refractory materials for vitrification, graphite arc, and plasma hearth processes.

3.2.3.2 Site Specific Needs. This section includes site specific needs identified during the site visits. In some cases, the same need was identified by multiple sites.

3.2.3.2.1 DOE-AL, SRS, and INEL have a need for commercial and/or mobile treatment unit(s) for organic removal and destruction from PCB contaminated LLW soils, sludges and debris, in compliance with TSCA and RCRA LDR.

3.2.3.2.2 DOE-AL needs to treat inorganic sludge contaminated with organics, including TCE.

3.2.3.2.3 DOE-AL needs commercial thermal desorption capability for eliminating organic contamination of sludge/soil waste streams, allowing RCRA LDR compliant disposal.

3.2.3.2.4 Ohio and RFETS need commercial and/or mobile treatment unit(s) for decontamination of soils and sludges contaminated with organics, metals (specifically, mercury for RFETS), and radionuclides to meet LDR requirements.

3.2.3.2.5 ORR and INEL need capability for in-situ characterization of radionuclides and RCRA constituents in tank wastes.

3.2.3.2.6 INEL has an immediate need for treatment of sludges containing up to 2% TCE and > 300pCi/l Cs-137 as well as DCE, vinyl chloride, chromium, Sr and U to meet LDRs. This need must be met by December 1995.

3.2.3.2.7 INEL has a need to treat miscellaneous tank sludges containing U, Pu, FP, Ba, Cr, Pb, and organics to meet LDRs.

3.2.3.2.8 SRS has a need for sorting and immobilization of soil contaminated with organic, metal, and radioactive constituents, including tritium.

3.2.4 Debris/Solids

The needs in this section are specifically applicable to the mixed waste identified as Debris/Solids.

3.2.4.1 General Needs. The needs listed in this section are generally applicable complex-wide.

3.2.4.1.1 A need exists to conduct comparative evaluation testing among leading thermal processes to select technologies most applicable to DOE requirements. One or two waste streams will be used to generate comparable data for all processes to be considered. The data set will be collaboratively designed with end-users to support evaluation.

3.2.4.1.2 A need exists to conduct comparative evaluation testing among leading non-thermal processes to select technology most applicable to DOE requirements. One or two waste streams will be used to generate comparable data for all processes to be considered. The data set will be collaboratively designed with end-users to support evaluation.

3.2.4.1.3 A need exists to demonstrate minimum additive wastes (MAWS) concept for leading thermal treatment technology by evaluating site waste inventories for practical waste combinations for synergistic treatment.

3.2.4.1.4 A need exists to demonstrate and facilitate capability for removal of surface organic contaminants for LDR compliant disposal of debris. Techniques include water or solvent extraction, thermal desorption, and chemical destruction. (This need was identified by Rocky Flats, but is considered a DOE complex-wide need. This activity could be combined with Debris/Solid General Need 3.2.4.1.2.)

3.2.4.1.5 A need exists to facilitate commercial and/or mobile debris macro/microencapsulation capability for LDR compliant disposal.

3.2.4.1.6 A need exists to development more durable refractory materials for vitrification, graphite arc, and plasma hearth processes.

3.2.4.2 Site Specific Needs. This section includes site specific needs identified during the site visits. In some cases, the same need was identified by multiple sites.

3.2.4.2.1 SRS has a specific need relative to the extensive Pu^{238} contamination is a primary concern for SRS and adds complexity to addressing their mixed waste needs. For this reason, Savannah River personnel are interested in a hybrid plasma melter, which combines a Russian plasma unit with an induction melter, rather than the fixed-hearth plasma process or joule-heated melters currently supported by the MWFA, and the rotary-hearth plasma and DC arc technologies currently supported by the Landfill Focus Area. The hybrid unit is favored because it is not refractory lined, which may reduce the potential for the spread of Pu^{238} and Pu^{239} contamination that can occur during refractory removal and replacement. This unit should be considered for inclusion in evaluations.

3.2.4.2.2 Ohio and SRS have a need for commercial and/or mobile treatment unit(s) for organic removal and destruction, including PCB from LLW soils, sludges and debris, (trimixed wastes) in compliance with TSCA and RCRA LDRs.

3.2.4.2.3 Ohio and INEL would like to evaluate the potential for steam-reforming in conjunction with a plasma or arc-furnace process to eliminate PIC formation and the subsequent need for a secondary combustor.

3.2.4.2.4 Ohio and INEL have a need to increase the electrode life in a plasma arc unit (i.e. > 1000 hours).

3.2.4.2.5 ORR and RFETS need commercial thermal desorption capability for LDR compliant disposal of radioactive debris contaminated with PCBs, mercury, and other volatile constituents.

3.2.4.2.6 Hanford and SRS need the capability to treat mixed waste debris that contains alpha-contaminated PCBs, lead, and mercury.

3.2.4.2.7 INEL needs a solid waste mixer and extruder-feeder system for installation onto a top vertically-fed DC arc melter being developed by Pacific Northwest Laboratory at Hanford. This feed system is necessary to remotely condition heterogeneous waste streams such as metals, combustibles, sludges, concrete, cloth, paper, and plastics. This work should be coordinated with the LFA and the RCP.

3.2.4.2.8 INEL has a need for a remote melter tapping mechanism to separate and remove the slag and metal secondary streams from high temperature furnaces. This capability is necessary for handling the residuals generated during treatment of radioactive waste streams. This work should be coordinated with the LFA and the RCP.

3.2.5 Unique Wastes

The needs in this section are specifically applicable to the mixed waste identified as Unique Wastes.

3.2.5.1 General Needs. The needs listed in this section are generally applicable complex-wide.

3.2.5.1.1 A need exists to evaluate mercury treatment technologies, including amalgamation and KI/I, to select the technologies that will provide reliability and the lowest life-cycle cost for removing/separating mercury from waste streams, particularly in the presence of specific contaminants.

3.2.5.2 Site Specific Needs. This section includes site specific needs identified during the site visits. In some cases, the same need was identified by multiple sites.

3.2.5.2.1 DOE-AL needs small low-cost or mobile unit to process several waste streams, including, radioactively contaminated reactive/pyrophoric metals and oxidizers, tritium-contaminated organics, reactive and oxidizing materials, such as cyanides and nitrates, complex lead shapes with internal surfaces that cannot be grit blasted, and tritium and mercury bearing wastes.

3.2.5.2.2 DOE-AL and INEL need commercial capability for lead decontamination for recycle or LDR compliant disposal. This is likely a need for other sites as well.

3.2.5.2.3 DOE-AL and ORR need to treat compressed gas cylinders and aerosol cans, including both surface contamination and radioactive gases in damaged and unlabeled cylinders of all sizes.

3.2.5.2.4 DOE-AL needs to treat wastes with complex physical forms including pumps, a large magnet,

and fluorescent tubes. This is likely a need for many other sites as well.

3.2.5.2.5 DOE-AL needs to treat accountable items such as weapon mock-ups.

3.2.5.2.6 ORR and RFETS need commercial microencapsulation and/or stabilization capability for LDR compliant disposal of beryllium fines.

3.2.5.2.7 ORR needs capability for commercial decontamination for recycle and/or macroencapsulation for LDR compliant disposal of lead and batteries.

3.2.5.2.8 ORR and RFETS need small low-cost or mobile units to process small problematic radioactively contaminated reactive metal streams. The need at RFETS is specifically for cyanides.

3.2.5.2.9 ORR needs small low-cost or mobile units to process small problematic radioactively contaminated explosive and propellant streams including sodium azide.

3.2.5.2.10 INEL needs the capability to decontaminate volume contaminated lead sheets, bricks, shot, and other miscellaneous that are in storage at various facilities at the INEL. Decontamination capability should include radioactive and hazardous constituents. The only currently available option is macroencapsulation, thereby disposing of the potentially reusable lead.

3.2.5.2.11 ORR needs technology for volume reduction and stabilization of high-activity MLLW.

3.2.5.2.12 Hanford and Ohio have a need for sorting, characterization and treatment of lab packs and scintillation cocktails. This is likely a need for other sites as well.

3.2.5.2.13 SRS is trying to get a "debris-like" ruling from EPA so they can use macroencapsulation for Silver Coated Packing Material (SR-W009) - silver coated beryl saddles with relatively high levels of radioactivity. No other treatment exists for this remote handled waste, in the event that EPA does not cooperate.

4. POTENTIAL QUICK WINS IDENTIFIED FOR THE DOE COMPLEX

This section includes all the potential quick wins identified during the site visits. These quick wins are generally grouped by site; however, some of the listed activities affect multiple sites. Presently, these potential quick wins have only been identified for investigation. Specific actions associated with these potential opportunities will be identified as the feasibility of these quick wins is investigated by the WTMs. Where initial investigation actions are ongoing, these are identified.

4.1 Albuquerque has a need for the capability to treat reactive materials, based on the current status of the Mobile Treatment Unit (MTU) program. Some initial attempts have been made to get these wastes treated at the sodium treatment facilities at Argonne National Laboratory-West (ANL-W), but to date there has been no resolution. The MWFA recommended that Albuquerque personnel contact Bob Washburn at ANL-W to further investigate the possibility

of treating some of these problematic waste streams at the INEL facilities rather than building a new treatment skid.

4.2 A long term action item at SRS relates to organic waste streams contaminated with significant amounts of tritium (i.e. 10,000 to 20,000 curies per drum). DOE-AL is proposing the Packed Bed Reactor/Silent Discharge Plasma (PBR/SDP) as a treatment, which has been identified in the SRS PSTP as the primary treatment option. However, based on the current schedule at SRS, this capability will not be needed until 2009. Tritium capture could be accomplished on molecular sieves or simply by complete condensation and stabilization in a grout. This need and potential match should be investigated further for potential implementation.

4.3 The plating waste skid at LANL has been somewhat over-designed, because of the early estimates of volumes to be treated. In addition, small volume cyanide wastes, originally intended to be treated by this MTU, may potentially be destroyed in treatability tests of the mediated electrochemical oxidation process being developed at LANL. This further reduces the demands on the plating waste treatment process. A potential quick win for this waste was identified during the MWFA meetings at AL. The Portable Water Treatment Unit (PWTU) operated at the INEL could possibly be moved to LANL to treat the remaining plating wastes without building a new MTU. The feasibility should be investigated further by the MWFA. In addition, other sources of cyanide waste streams should be investigated to determine if a bench scale plating waste treatment process is warranted. Treatment of residues with reactive metals has been identified as a need at RF.

4.4 A novel cold-plasma system utilizing carbon tetrafluoride (CF_4) to volatilize plutonium (Pu) contamination from debris to render the waste non-TRU was proposed by LANL personnel. This technology could potentially be used to treat glove boxes and other irregular, complex shapes that are difficult to decontaminate using conventional processes.

4.5 A process for treating high explosives to replace open burning is needed by Pantex. Currently, a base hydrolysis process has been proposed as an alternative treatment. The EM-30 customer at Pantex has agreed to implement this technology if it can be successfully demonstrated by the MWFA.

4.6 The Uranium Chips treatment MTU is ready for treatment demonstration, but larger quantities need to be identified to warrant demonstration and implementation. The MWFA has identified needs for this skid at Oak Ridge (100 drums from remediation of a disposal trench) and, possibly, the INEL.

4.7 The polymer filtration process, which is currently funded by the Efficient Separations Crosscutting Program, utilizes specially designed water-soluble polymers that selectively bond with the metal ions in the rinse bath. The advantages of this process are that it allows recovery of the plating metals for recycle into the electroplating bath and provides a high degree of metal ion selectivity. The polymers have such a large molecular weight that they can be physically separated using available ultrafiltration technology. This technology could potentially be demonstrated on waste streams with various types of heavy metal contaminants, which may eliminate some small volume waste streams.

4.8 The SNL-CA mercury monitor may have immediate applicability on the low temperature thermal desorption unit at Grand Junction. In addition, this monitor may be able to be incorporated into the TVS unit.

4.9 A primary need for Fernald is to get a final regulatorily acceptable definition of macroencapsulation as it relates to disposal at Envirocare. The MWFA has a task force that is specifically addressing this issue. This effort is attempting to get acceptance of the use of specific types of sealed containers in meeting the requirements for macroencapsulation. An additional related issue dealing with acceptable void volume in the containers will most likely be resolved on a site-by-site basis.

4.10 Fernald has identified 50 m^3 of PCB contaminated mixed waste solid debris for which they do not have a treatment identified that supports their remediation schedules. The TSCA incinerator at Oak Ridge has generally been believed to not be able to treat solid wastes; however, during the recent site visit to Oak Ridge the MWFA was told that this facility is permitted to burn solid wastes and can process up to one million pounds annually. State EPA representatives that were present at the time indicated that treatment of the Fernald waste is possible, but that some equity issues would have to be worked out. The appropriate WTMs should support this activity in whatever way the sites indicate that they can. Originally, Fernald, wanted to send this tri-mixed waste to the ANL-W facility for treatment in the plasma hearth process (PHP) unit being installed and tested there. However, potential problems exist related to the timing of the treatment of TRU waste that is planned to be processed in the PHP and treatment of the Fernald trimixed waste. If Fernald's waste is processed after the TRU waste, then the treated Fernald waste would most likely be contaminated with TRU constituents and would not meet the Envirocare WAC. In addition, the efficiency of PHP in treating polychlorinated biphenyls (PCBs) without generating dioxins in the offgas has not been determined. Consequently, the use of the TSCA incinerator appears to be a much better option, if possible.

4.11 Five m^3 of lead waste, including gloves, lead-acid batteries, and bulk lead at Mound could be eliminated from this site's inventory with a treatability study of macroencapsulation, such as the INEL agreement with Envirocare.

4.12 Mound has one drum of PCB-contaminated oil that could be eliminated from the inventory if used as the waste stream in a treatability study in the thermal desorption process or some other technology.

4.13 Three major mixed waste treatability studies are planned or ongoing at Fernald. These include a stabilization treatability study, a chemical treatment treatability study, and a mercury treatment treatability study.

> The Stabilization Treatability Study is addressing size reduction, cementation, and chemical stabilization requirements for several waste streams, including grit blast residue, solidified furnace salts, sump cakes, construction rubble, and miscellaneous trash. Thus far, waste loadings have been identified for some of these waste streams, and ammonia emanation studies are ongoing.

The Chemical Treatment Treatability Study is addressing extraction methods/reagents, optimal particle size, and final waste form for several waste streams, including debris, soils/sludges, lead solids, magnesium, barium chlorides, acids/caustics, uranium oxide, and cobalt triflouride. Planned activities include debris washing, solvent extraction, decontamination baths, "petroset" stabilization, dissolution/precipitation, neutralization, and deactivation using controlled reactions. These treatability studies are scheduled to be completed by September 15, 1995.

The Mercury Treatment Treatability Study is addressing RCRA LDR compliance, mercury concentrations, and scale-up optimization for several waste streams, including elemental mercury, mercury contaminated debris/water/residue, mercury contaminated salts, florescent light tubes, and mercury batteries. Planned activities include amalgamation with copper, precipitation, and decontamination.

These studies should be coordinated with needs identified throughout the complex by the MWFA to optimize the waste streams chosen for demonstration such that the greatest effect is realized on the DOE inventory. In addition, the data developed should be used to evaluate against other processes that are being investigated. The MWFA needs to coordinate with Fernald to ensure that efforts are not duplicated.

4.14 Compressed gas cylinder treatment/disposition capability is needed by Oak Ridge. This is a potential quick win for the gas cylinder mobile treatment unit that the Albuquerque Operations Office has developed.

4.15 Nine drums of PCB wastes in storage at SRS are to be processed by Rust. The MWFA could possibly facilitate shipping other similar wastes for treatability studies, thereby eliminating waste streams from the inventory.

4.16 SRS has two drums of elemental calcium which could be eliminated in a treatability study.

4.17 SRS has a functional CO_2 blasting surface decontamination system that could possibly be used by others or copied for use in treatability studies/demonstrations elsewhere

4.18 A TRU vent-and-purge device is to be demonstrated at SRS by mid-July, which may be useful for drummed storage at many sites. The MWFA should investigate the results of the demonstration and its applicability throughout the complex.

5. TREATABILITY STUDY AND TREATMENT DEMONSTRATION CAPABILITIES IN THE DOE COMPLEX

The sites visited by the MWFA have numerous ongoing technology development activities. Many of the process systems and facilities associated with these technologies have the capability to perform treatability studies and treatment demonstrations on mixed waste. In addition, several of the sites in the DOE complex have operational "hot cells", not presently supporting development activities for any specific technology,

that could be used to support treatability studies or treatment demonstrations, pending regulatory approval. The specific capabilities at each site associated with the technology development activities supported by, or pertinent to, the MWFA are discussed below. Some of this information was previously provided in Section 4 in relation to specific quick wins.

The INEL has many ongoing technology development activities. A major effort is in the plasma hearth development work. Facilities at Argonne National Laboratory-West (ANL-W) have been, or are planned to be, used to perform treatment demonstrations in the bench scale plasma hearth process on surrogate materials and actual mixed waste. Other plasma hearth surrogate demonstrations have also been performed at ANL-W facilities for the Pit 9 Remediation Project. The Scientific Applications International Corporation (SAIC) Testing and Research (STAR) Facility, where the pilot scale plasma hearth system is being constructed, can also conduct nonradioactive surrogate testing. In addition, hot cells at ANL-W, Test Reactor Area, and Idaho Chemical Processing Plant can be used for treatment of radioactive materials. Another avenue that the INEL has to conduct treatability studies is through a partnering arrangement with the Idaho State University, which is part of the Associated Western Universities (AWU) group.

Savannah River Site also has several facilities/systems that can provide surrogate and radioactive testing capabilities. The Transportable Vitrification System (TVS), which will actually be located at the Oak Ridge K-25 Plant, will perform treatment demonstrations on the B&C pond sludge mixed waste, as well as other Oak Ridge waste streams. Savannah River Site will also perform radioactive demonstrations using the 260-gallon capacity version of the Delphi Inc., Detox™ system in FY1996. Savannah River Site has strong partnerships with university and commercial facilities at the Clemson Technical Center. Rust Federal Services, Inc. (Rust) has a facility at the Clemson Technical Center that is approved to perform radioactive treatability studies and treatment demonstrations. In addition, Clemson has a facility that conducts research on joule-heated melters, graphite arc melters, and stirred melters. This facility can perform surrogate testing only.

Fernald has three major treatability studies ongoing or planned. A stabilization treatability study is addressing size reduction, cementation, and chemical stabilization requirements for several Fernald waste streams, including debris and non-debris wastes. Fernald also is completing chemical treatment treatability studies for several technologies including debris washing, solvent extraction, decontamination baths, “petroset” stabilization, dissolution/precipitation, neutralization, and deactivation using controlled reactions. These technologies are capable of processing a wide variety of waste streams including debris, soils, sludges, lead solids, reactive metals, etc. Treatability studies on several different types of mercury waste streams, ranging from elemental mercury to mercury batteries to mercury contaminated water, are planned by Fernald. Technologies will include copper amalgamation, precipitation, and decontamination techniques.

Hanford Reservation is currently planning to have virtually all of its stored mixed waste treated by a commercial entity in a commercial facility. Accordingly, very little treatment demonstrations or treatability studies are expected to be performed for this waste. However, ongoing work performed by Pacific Northwest Laboratories (PNL), which is supported by the Landfill Stabilization Focus Area, is developing a DC arc melter vitrification technology. This system is capable of performing treatability studies on actual mixed waste, as well as surrogates. Treatment demonstrations/treatability studies will be performed throughout FY1996. The PNL facilities have additional hot cell areas in which radioactive

demonstrations could potentially be performed. In addition, the High Level Waste Tank Remediation (Tanks) Focus Area has an active program at Hanford. The Tanks Focus Area is addressing remote handling/retrieval of waste in tanks and debris in hot cells that could be potentially applicable to the MWFA, as well as other focus areas.

The sites under the purview of the DOE-AL have performed numerous treatability studies and treatment demonstrations. All of these were not covered during the MWFA site visit; however, the prevalent ones were discussed. DOE-AL has developed a Mixed Waste Treatment Plan[21] for all of its mixed waste. This plan is based on the use of mobile treatment units (MTUs) to process DOE-AL mixed waste. Currently, this plan includes the use of six main MTUs: Thermal Desorption, Wastewater Evaporation, Lead Decontamination , Mercury Amalgamation, Packed Bed Reactor/Silent Discharge Plasma, and Macroencapsulation. Each of these MTUs has completed, or will complete the necessary surrogate and radioactive treatability studies and demonstrations to validate the operation of the skids. In addition to these technologies, DOE-AL has completed treatability studies or treatment demonstrations on mediated electrochemical oxidation, low temperature thermal desorption, and steam reforming. Some other innovative technologies that have been or will be demonstrated are carbon tetraflouride cold plasma decontamination of plutonium and polymer filtration using chelating agents.

As previously stated, the Oak Ridge Reservation (ORR) is involved in demonstration of the TVS, which is being jointly developed by ORR and SRS. A treatment demonstration on B&C pond sludge will be completed in the second quarter of FY1996. Oak Ridge Reservation is involved in a second large scale demonstration, the Vortec Vitrification Demonstration Project, which is part of the scope of the Morgantown Energy Technology Center (METC) efforts. Treatability studies have also been performed at ORR on the KI/I_2 mercury removal process. Additional studies are ongoing. Use of a plasma torch to vitrify thorium nitrate has also been successfully demonstrated at ORR. Continuation of additional demonstrations using this technology will be based on the results of a comprehensive review by the MWFA of the vitrification technology development activities ongoing within the DOE complex.

Rocky Flats Environmental Technology Site has also been involved in demonstrations of several technologies. Extensive treatability studies have been conducted on polymer macroencapsulation and, to a lesser degree, microencapsulation. This testing has included the preliminary study of the effects of high radioactivity mixed wastes on the encapsulation polymer. Rust VacTrax™ is a low temperature thermal desorption process that has been demonstrated at RFETS. Rocky Flats would like to perform treatability studies on the liquid chemical extraction process, which is used to separate washing solutions from particulate waste. Demonstration of a microwave solidification technology will be performed, as required, to evaluate radionuclide migration in the system. Further offgas testing is also required for the microwave technology. Actual mixed wastes have been treated at RFETS using polymer encapsulation, VacTrax™, and the microwave solidification technologies. Additional information on the status of these projects can be obtained from the RFETS site visit report, included in Addendum B, or from the MWFA site contacts identified for RFETS in Table 2.2.

A strong partnership exists between RFETS and the University of Colorado at Boulder. A supercritical carbon dioxide extraction unit is located at the University of Colorado Cooperative Institute for Research in Environmental Sciences. Surrogate testing could be performed in this facility.

6. SITE SPECIFIC REGULATORY INFORMATION

The sites in the DOE complex are managed within a very complex regulatory framework. Numerous regulatory agencies and governing documents drive the activities specifically associated with mixed waste management. For the sites visited by the MWFA, a listing of regulatory agencies, agreements, consent orders, decrees, etc. has been included in Table 6.1. The information provided is fairly comprehensive, but should not be considered all-inclusive.

The regulatory situation at each site is unique and, in many cases, the successful implementation of an identified quick win will be contingent on resolving these differences. In addition to site specific regulatory requirements, other complex-wide regulatory issues will continue to affect the MWFA activities. Examples include the DOE shipping moratorium, which is a direct result of the lack of established release criteria for radioactively contaminated material, and the need for clarification of the definition of "macroencapsulation". The MWFA can support resolving these types of issues; however, final resolution will have to be in the form of guidelines promulgated by the applicable regulating bodies.

For instance, the definition of macroencapsulation, as stated in an interpretive guidance memorandum from EPA's Office of Solid Waste to EPA Region VIII on February 16, 1994, raised questions concerning the applicability of the process identified in the Pantex PSTP for macroencapsulation of mixed waste debris. Other sites, as well as commercial vendors, had similar concerns about what processes are acceptable. The MWFA addressed this issue by initiating conversations with EPA Office of Solid Waste, through DOE-HQ, about this issue. As a result, EPA's definition of acceptable macroencapsulation processes has recently been clarified in a September 19, 1995 letter from Richard Kinch, Chief of the Waste Treatment Branch of the EPA Office of Solid Waste and Emergency, to Kevin Igli, Vice President of Environment, Health, and Safety at Chemical Waste Management, Inc.[22]

Unique site specific regulatory situations that affect the MWFA were previously mentioned. An example of this is related to use of incineration to treat mixed waste streams. Regulators in the states of California, Colorado, and Ohio have determined that incinerators will not be permitted for the treatment of mixed wastes in their respective states. These rulings have caused DOE to focus substantial technology development efforts toward demonstrating nonthermal treatment alternatives for mixed waste. Another example of a unique site specific regulatory situation exists at the Portsmouth Gaseous Diffusion Plant in Ohio. A very aggressive schedule for remediating this site under CERCLA has been negotiated with the state regulators. However, this site is also regulated by RCRA. Because the administrative processes for obtaining permits to operate RCRA treatment facilities is extensive, the established remediation schedules would be at risk. As a result, DOE-Ohio Field Office has been able to utilize Director's Findings and Orders (DF&Os) to expedite treatment of mixed wastes using proven technologies, while awaiting a RCRA operating permit.

Another unusual situation exists with the TSCA incinerator at the Oak Ridge K-25 Plant. As previously mentioned, this incinerator was generally believed to not be able to accept solid waste streams due to permit and feed handling limitations. The MWFA has recently been informed by regulators from the State of Tennessee that the TSCA incinerator is currently permitted to accept solid feed and that the state would be willing to accept out-of-state waste streams, provided equity situations are discussed and resolved. The existing TSCA incinerator solid feed handling system, although manual, can process approximately 1,000,000 lbs of material per year.

Undoubtedly, as the MWFA continues to analyze the waste stream data, investigate regulatory limitations, and evaluate treatment options, more situations will surface that the Focus Area can capitalize upon to bring additional waste streams and sites into compliance with RCRA, CERCLA, and other applicable regulations. The MWFA will provide support to address any regulatory issues that result from technology

Table 6.1 Regulatory Agencies and Governing Documents for DOE Sites

Site	Regulatory Agencies	Existing Agreements / Orders	Summary
INEL	Environmental Protection Agency (EPA) Region X Idaho Department of Environmental Quality	Federal Facility Agreement / Consent Order	This agreement mandates compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and with Corrective Action requirements of the Resource Conservation Recovery Act. It also determines that CERCLA waste may be managed at Site Treatment Plan (STP) facilities.
		FFCA	This act, which will be followed by a consent order, provides a time period for all DOE sites that are not in RCRA compliance to implement an LDR treatment plan. Deliverables involve planning, construction, and treatment schedules for mixed waste.
Rocky Flats	EPA Region VIII Colorado Department of Public Health and the Environment	Settlement Agreement.	This agreement requires RFETS to process mixed residues into a shippable / disposable form as expeditiously as possible.
		Judicial Orders	These orders define some specific permitting requirements for RFETS and related deliverables.
		Interagency Agreement (IAG)	This IAG addresses CERCLA and RCRA clean-up requirements at Rocky Flats.
		FFCA	This act, which will be followed by a consent order, provides a time period for all DOE sites that are not in RCRA compliance to implement an LDR treatment plan. Deliverables involve planning, construction, and treatment schedules for mixed waste.

Site	Regulatory Agencies	Existing Agreements / Orders	Summary
Fernald	US EPA State of Ohio	Consent Decree	This decree defines the required milestones to bring the Fernald site into full compliance with RCRA.
		Consent Agreement.	This agreement creates five Operable Units for CERCLA clean-up at Fernald. Fernald is governed under RCRA and CERCLA jointly; consequently, the Operable Units are referred to as CERCLA/RCRA Units (CRUs).
		FFCA	This act, which will be followed by a consent order, provides a time period for all DOE sites that are not in RCRA compliance to implement an LDR treatment plan. Deliverables involve planning, construction, and treatment schedules for mixed waste.
Mound	US EPA State of Ohio	Federal Facility Agreement (FFA)	This act provides procedural and substantive requirements for Remedial Investigation / Feasibility Study (RI/FS) work under CERCLA.
		FFCA	This act, which will be followed by a consent order, provides a time period for all DOE sites that are not in RCRA compliance to implement an LDR treatment plan. Deliverables involve planning, construction, and treatment schedules for mixed waste.
Portsmouth Gaseous Diffusion Plant	Ohio EPA US EPA	Director's Findings and Orders (DF&O) (May 17, 1993)	This DF&O provides for exemption from mixed waste LDRs pending development of an alternative compliance mechanism.
		Judicial Consent Decree	This decree requires RCRA closures and evaluation of site contamination, in addition to CERCLA compliance.

Site	Regulatory Agencies	Existing Agreements / Orders	Summary
		EPA Consent Order	This consent order requires investigation of past disposal practices and implementation of the ensuing RCRA Corrective Actions that are required.
		FFCA	This act, which will be followed by a consent order, provides a time period for all DOE sites that are not in RCRA compliance to implement an LDR treatment plan. Deliverables involve planning, construction, and treatment schedules for mixed waste.
		DF&O (July 15, 1991)	This DF&O provides for exemption from certain RCRA permit requirements, pending issuance of an actual permit, to allow remediation of the site to continue.
Hanford	EPA Region X Washington State Department of Ecology	Tri-Party Agreement	This agreement was entered into to bring Hanford into compliance with dangerous waste regulations. Includes LDR plan. The Tri-Party Agreement has been determined to meet the same intents and requirements of the FFCA for Hanford.
Los Alamos National Laboratory (LANL)	EPA Region VI New Mexico Environmental Department (NMED)	FFCA	This act, which will be followed by a consent order, provides a time period for all DOE sites that are not in RCRA compliance to implement an LDR treatment plan. Deliverables involve planning, construction, and treatment schedules for mixed waste.
		LANL Consent Agreement	This agreement defines requirements and schedules for compliance and remediation of earthen-covered storage.
		LANL Clean Water Act-FFCA	This act addresses Clean Water Act violations.

Site	Regulatory Agencies	Existing Agreements / Orders	Summary
All other sites under the purview of the DOE-AL.	EPA Region VI NMED	FFCA	This act, which will be followed by a consent order, provides a time period for all DOE sites that are not in RCRA compliance to implement an LDR treatment plan. Deliverables involve planning, construction, and treatment schedules for mixed waste. (This is applicable to SNL-NM, SNL-CA, Grand Junction, Kansas City Plant, and Pantex .)
Oak Ridge National Laboratory	EPA Region IV Tennessee Department of Environment and Conservation	FFCA	This act, which will be followed by a consent order, provides a time period for all DOE sites that are not in RCRA compliance to implement an LDR treatment plan. Deliverables involve planning, construction, and treatment schedules for mixed waste.
		Commissioner's Order	This Order requires RCRA LDR compliance for Oak Ridge pond sludges.
		FFA	This act directs the comprehensive clean-up of the site under CERCLA and RCRA.
SRS	EPA Region IV South Carolina Department of Health and Environmental Control	FFCA	This act, which will be followed by a consent order, provides a time period for all DOE sites that are not in RCRA compliance to implement an LDR treatment plan. Deliverables involve planning, construction, and treatment schedules for mixed waste.
		FFA	This act directs the comprehensive clean-up of the site under CERCLA.

development activities or implementation of potential quick wins. However, the Focus Area wants to emphasize the fact that it has no intention to get involved in any site specific regulatory issues or concerns unless support is explicitly requested by that site. The relationships that exist between the site representatives and state regulators have taken substantial time and effort to develop, and are based on earned trust. Consequently, the MWFA will always limit its interactions with the regulators to ensure that the relationships between the site and governing state are improved or not negatively affected.

As the technical baseline is implemented, identified technology gaps are addressed and resolved, and the majority of the waste streams in the DOE complex have a defined treatment process, the efforts of the MWFA will shift toward implementation of more quick wins and addressing the problem waste streams in the waste type categories. These situations will generally involve more multiple site regulatory interactions, which will most likely require more support from the MWFA.

7. STATUS OF PRIVATIZATION EFFORTS

Recently, in an effort to be more cost-effective, DOE-HQ has focused more resources on identifying privatization opportunities for the treatment of the mixed waste in the DOE complex. In this context, privatization means that private vendors build and operate treatment facilities to treat waste. This is not the same as a site purchasing a piece of commercially available equipment that is subsequently operated by DOE. The primary approach of this effort is to issue requests for proposals (RFPs) to the general market, which are then responded to by interested parties. The vendor is eventually selected from among the resulting bids. The use of a competitive bid process is expected to result in a lower overall cost to DOE. During the site visits the MWFA obtained information about the ongoing privatization efforts at those sites.

In October 1994, the INEL awarded a contract to Lockheed Martin Environmental Systems and Technology (LMESAT) to treat waste from the Pit 9 landfill, which consists of mixed debris and soil. LMESAT, currently in the demonstration phase, is using a plasma torch with a rotating hearth. In June 1996, INEL will award a contract to process the current inventory of alpha and TRU low-level mixed waste. This waste consists of containerized mixed debris. DOE-ID has also established a Cooperative Agreement with Envirocare of Utah, Inc. to perform treatment demonstrations for macroencapsulation of a wide variety of lead and debris waste streams. This activity may be a forerunner to the DOE complex-wide macroencapsulation contract that Pantex is investigating.

Oak Ridge is pursuing private sector treatment of about 85% of the current mixed waste inventory through various efforts. A contract is in place with Scientific Ecology Group (SEG) to use a joule-heated melter to treat sludge from the West End Treatment Facility. In the first phase, SEG will build a pilot plant to demonstrate the concept. Pending successful completion of the pilot plant, a full-scale system will be built. A similar effort will be initiated to treat B&C pond sludge. Other efforts include private vendor recycling of fluorescent light bulbs and treatment of scintillation cocktails. Oak Ridge also uses Envirocare of Utah, Inc. to dispose of waste, but does not currently use them for treatment. An RFP is presently being developed to treat a broad spectrum of waste streams, including soils, sludges, debris, metals, lab packs, batteries, and compressed gas containers. During Phase 1, two vendors will treat up to 100,000 kg of

waste from at least three of these target waste streams. One of the Phase 1 vendors will then be selected to proceed to full scale during Phase 2, based on Phase I performance.

Hanford is planning to privatize treatment of virtually all the low-level mixed waste on the site. They have issued an RFP for a new thermal treatment facility to treat mixed waste. Responses have been received and the selection process is ongoing; however, the funding for this proposal is unsure at this time. A second RFP is being prepared to address commercialization of the stabilization process that was originally going to be part of the Waste Receiving and Processing Facility (WRAP IIA) at Hanford. This will be a stabilization service contract.

Because the sites under the purview of DOE-AL do not generally have large quantities of waste, their strategy has been to construct mobile treatment units to move from site to site as necessary to treat waste. Current activities for privatization are limited. The only ongoing privatization effort is the initiative by Pantex to establish a DOE complex-wide lead/debris macroencapsulation contract at Envirocare. This activity is in the early stages, but success of the current Cooperative Agreement that DOE-ID has established with Envirocare may set a precedent that allows a complex-wide contract to become a reality.

Fernald has been actively treating mixed waste for some time, but has no plans for privatization other than to use Envirocare for disposal of waste treated at Fernald.

Rocky Flats has no plans for privatization of treatment of the mixed waste at that site. RFETS is pursuing several treatment technologies, including polymer encapsulation, low temperature thermal desorption, supercritical CO_2 extraction, and microwave vitrification. Requests for line item funding have been initiated for each of these technologies to be built and operated by Rocky Flats personnel.

Savannah River Site has recently placed an announcement in the Commerce Business Daily to privatize the Transportable Vitrification System at the end of its demonstration, which will undergo testing at Oak Ridge during 1996. With the exception of shipping contaminated lead to Envirocare for encapsulation and disposal, SRS has no other current plans for privatization.

8. IMPLEMENTATION

The needs identified in this document will be used by the WTMs as the major input into development of the MWFA technical baseline. This baseline will be an integrated strategy that incorporates sound engineering judgement, the site identified technology needs, and cost-effective planning to define the most efficient system for treating the DOE complex mixed waste. However, the MWFA does not have the resources to address every need or investigate every potential win that supports the technical baseline, in any given fiscal year. Consequently, the needs and potential quick wins that have been identified must be prioritized such that the greatest affect is realized for the DOE complex.

The framework of the technical baseline will be treatment process flow systems that are developed for all of the waste types. Each waste category will have primary and alternative treatment process flows, depending on the diversity of the waste streams within the specific waste type. The WTMs, in conjunction with the TRT and Technical Support Team (TST), will define the treatment process flow systems for the waste types. Previous work will be utilized to the fullest extent to ensure that the analysis is as

comprehensive as possible. The technology development needs identified by the sites will then be associated with the specific functions within these treatment process flows. Accordingly, the priority of a need will be directly related to the priority of the specific treatment process flow system.

Prioritization of the individual technical task plans (TTPs) that implement the technical baseline is a multiple tiered process. The priority of the TTP is based not only on the technical merits of the proposed work, but also on the priority of the "need" that it addresses. The priority of a "need" is based on the priority of the treatment process flow system or systems that it is associated with. The priority of treatment process flow system is based on the overall affect that development and implementation of that system would have on the DOE complex mixed waste inventory. The MWFA TRT, in conjunction with the WTMs, is presently developing the prioritization systems necessary to define and evaluate the technology development activities that are supported by the MWFA.

Once the technology development work within the MWFA has been prioritized, the details of the technical baseline will be established. However, the DOE system is very dynamic and constantly changing. That is why, as previously stated, the technical baseline, which will be managed by the WTMs and their support teams, will be evaluated semi-annually, and the supporting projects will be reviewed quarterly to ensure that the EM-30, 40, and 60 priority needs are being met in the most timely and cost-effective manner. As the situation in the DOE complex mandates changes to the technical baseline, the WTMs will use directed calls for proposals to address new/different needs. The prioritization system developed will be used to evaluate the TTPs that are submitted in response to these directed calls to ensure that the work supported by the MWFA continues to be as efficient as possible.

9. CONCLUSION

The initial data developed by the MWFA, and presented in this report, is an excellent step toward defining, addressing, and resolving the needs of the EM-30, 40, and 60 customers in the DOE complex. The information collected to date is recognized as the *beginning*, and substantial refinement of this compilation will be accomplished in the ensuing months. Consequently, this report is considered to be a "living" document that will be updated at least annually. As the technical baseline becomes more mature, it will be more fully defined in this report.

The quarterly and semi-annual reviews of the MWFA program, previously defined, will ensure that the customer needs are identified, addressed, and eventually resolved. In addition, these reviews will ensure that the strategy for accomplishing this is properly documented.

The use of directed calls for proposals, which is a departure from the historical approach of issuing general calls for proposals, is seen as one of the most useful tools that the MWFA will have. Technically specific calls for proposals will be issued that are directed at resolving particular customer needs. This process is so beneficial because it allows the MWFA to consistently make comparative evaluations of proposals, ensuring that the prioritization process produces the most efficient, cost-effective, timely decisions. The end result will be a technically defensible, documented baseline that is guaranteed to meet the EM-30, 40, and 60 needs, as they are defined at the time of evaluation.

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ADDENDUM A
STANDARD QUESTIONS FOR SITE VISITS

Standard Questions for Site Visits

1.a. Do you have technology needs in addition to those identified in the preliminary needs assessment developed by the MWFA?

1.b. If so, what are these needs and to what waste streams do they apply? Do any of these needs affect permitting/operating your facilities (e.g. real time metals continuous emission monitoring could facilitate permitting of an incinerator)?

Technology Need	Applicable Waste Stream(s)

1.c. Are there any changes to the data in the assessment that should be made?

2.a. From the attached list of ongoing EM-30 and EM-50 technology development work in the DOE Complex, are there any activities that could possibly support your needs?

2.b. If so, what specific data would you need from the activities to determine whether or not the technologies are applicable to waste streams at your site?

3.a. What are the ongoing and planned EM-30 technology development activities at your site that have not been included in the MWFA preliminary needs assessment?

3.b. What is the maturity, scope, and funding level for each of these activities? (Note: Maturity should be based on the categories identified in the PEG Guidance Document - DOE, April 21, 1995.)

4. Many of the technologies being developed with EM funding are now mature enough to identify their potential range of applicability to DOE wastes, permitting advantages, and life cycle unit costs. A comparative evaluation could be done for:

   •thermal organic destruction processes;
   •non-thermal organic destruction processes; and
   •treatment processes for organically contaminated wastewater.

   By eliminating less advantageous concepts from the MWFA portfolio, and concentrating on the “best” technologies, development might be accelerated, allowing redirection of resources to provide quick response to site-specific needs.

For most parameters to be compared, estimates can be made where data is lacking. However, in some cases, comparative data can only be developed through demonstrations with the same or similar waste streams. The MWFA plans to direct Principle Investigators to develop comparative operating data by modifying experimental plans to include testing with specific wastes. Data requirements are to be developed through collaboration with potential EM-30/40/60 customers.

a. Do you agree with this strategy?

b. Would you like to participate in developing the data requirements set? If so, can you provide the MWFA with points-of-contact?

5. As described above, properly executed evaluation of technologies could eliminate overlap, making funds available for more direct support of short term needs. Would it benefit your programs for the MWFA to evaluate and direct any of the EM-30/40/60 funded mixed waste technology development activities?

6. Site-specific considerations may override selection of the treatment technology that is the most technically applicable or cost-effective.

   a. Are there any specific constraints to be considered in evaluation of the prescreened/selected technologies for use at your facilities?

   b. Have any unusual conditions been placed on you by regulators concerning permitting or operating your treatment facilities (e.g. prohibitions on out-of-state waste, incineration, or mobile units; waste stream-by-waste stream pre-approvals, etc)?

   c. Do you have any specific packaging and/or transportation issues related to the mixed wastes at your site?

   d. Can you identify any site-specific overriding regulatory issues that you would want the MWFA to have addressed during the EPA-HQ/DOE-HQ Regulatory Reform Round Tables?

7. The MWFA is building on site needs to develop both site-specific and nationally integrated design criteria that can be satisfied by the selected technologies. Are there any specific considerations beyond your technology needs that you could suggest for the DOE Complex?

8. Have any waste streams been identified for treatment at your site from offsite sources that could potentially create treatment technology, regulatory, or other logistics problems?

9. In addition to identifying treatment technology systems that can treat 90% of the DOE Complex mixed wastes, the MWFA wants to help identify and implement treatment activities that can eliminate waste volumes from the DOE inventory in the near term. Can you identify any “quick win” treatment activities through treatability studies, University research partnerships, or use of commercial capabilities that the MWFA could assist you in accomplishing?

10.a. Do you have any ongoing or planned treatability studies that could potentially be used to treat wastes at other sites?

10.b. Have you performed any treatability studies in the past that could possibly be used at other sites? Could any of the data developed be beneficial in treating the DOE Complex mixed waste?

11. Do you have any issues concerned with privatization plans that the MWFA could assist your site in resolving?

12. What computer hardware and software capabilities does your site have that will allow electronic communication with the MWFA? Can you identify a point-of-contact that the MWFA can obtain this information from?

13. The MWFA is a new strategic approach to solving technology issues for mixed waste treatment. Its intent is not to start over, but to build on the best aspects of prior work to more efficiently use the available resources. Do you have any specific recommendations on how we can best support your programs?

ADDENDUM B
SITE TRIP REPORTS

ALBUQUERQUE NEEDS TRIP REPORT

ALBUQUERQUE NEEDS TRIP REPORT
August 1 - 3, 1995

1. INTRODUCTION

On August 1 - 3, 1995, representatives from the Mixed Waste Focus Area (MWFA) met with Department of Energy (DOE) and contractor representatives from sites under the purview of the Albuquerque Operations Office (AOO) to discuss their needs for technology development and regulatory support, as well as their potential treatment capabilities for mixed waste. Personnel from the MWFA included Julie Conner, Jay Roach, Dave Eaton and Dirk Gombert. Personnel from DOE-Albuquerque (DOE-AL) Los Alamos National Laboratory (LANL), Sandia National Laboratory (SNL)-New Mexico, SNL-California, Grand Junction Project Office, the Kansas Area Office, and Pantex were also present. The other DOE-AOO sites, including ITRI, Mound and Pinellas did not have representation present but were included in the discussions. The meeting agenda and list of attendees are included as Appendix A and Appendix B, respectively.

2. EXTENDED AGENDA, RESULTING ACTION ITEMS, AND RECOMMENDATIONS

The first day of the Albuquerque visit the MWFA met with representatives from DOE-AL, as well as DOE and contractor personnel from several of the sites under the purview of DOE-AOO. After introductions and a MWFA overview by Julie Conner DOE-Idaho Operations Office (DOE-ID), the day was spent in oral presentations covering the DOE-AOO philosophy supporting the mobile treatment concept, and the current status of the various mobile treatment units (MTUs). In addition, presentations were given by representatives from SNL-CA and Pantex about ongoing and planned work at these facilities. The second day was spent at LANL and included a morning session of presentations that were focused on LANL needs and capabilities. In the afternoon, the MWFA was taken to several areas where various treatment processes are under development and being testing. The morning of the third day was used to close out the meetings with DOE-AL and included discussing mutual observations and clarifying action items for the appropriate participants.

2.1 Day One Activities

Day one was spent at DOE-AL with oral presentations on the philosophy and current status of the Albuquerque MTUs, which form the basis of the Mixed Waste Treatment Plan (MWTP) developed by AOO. In addition, completed, ongoing, and planned activities that have been or will be used to eliminate mixed waste from the AOO inventory were discussed. Final options for long term treatment activities will undoubtedly be defined by the State of New Mexico. DOE-AL expects that the State will unilaterally issue the Federal Facility Compliance Act (FFCA) Consent Order, with little or no negotiation.

The mobile treatment concept was developed to satisfy treatment requirements at many sites with small,

problematic waste streams while addressing inter-state equity issues. Originally, 20 different treatment "units" were conceived, which included mobile (MTUs, as well as other available treatment capabilities such as the incinerator at Diversified Scientific Services, Inc. (DSSI). This number was initially pared down to 17 units for various reasons. In the Site Treatment Plan, the number of MTUs was further reduced to 12, and during the last week of July DOE-AL reevaluated the waste volumes to be treated by each unit and suggested only six MTUs for full implementation. This configuration is preliminary at this time and, presently, the sites under the purview of DOE-AL are evaluating this recommendation. The six recommended units are: 1) thermal desorption (based on the Rust VacTrax system), 2) wastewater evaporation, 3) lead decontamination, 4) mercury amalgamation, 5) the packed bed reactor/silent discharge plasma system, possibly equipped for tritium capture, and 6) macroencapsulation.

Of the six skids eliminated from the original twelve skids, four were recommended to be terminated, and the other two were recommended to be downsized to treat the current projection of waste volumes. The four to be terminated included: 1) evaporative oxidation, 2) gas cylinder treatment, 3) hydrothermal oxidation, and 4) stabilization, all of which may now have commercially available treatment available for the target wastes. The plating waste and reactive metal treatment skids will be resized to match current projected waste inventories.

Details on the capabilities and status of the proposed MTUs have been included in Appendix C. Data on the six skids recommended by DOE-AL for deployment are summarized below:

1. Process: Thermal Desorption
   Applicable Wastes: Organic and mercury contaminated solids
   Estimated Volumes: 389m^3
   Feed Rate: 0.41m^3 per 8-hr shift
   Status: Design being finalized, treatability tests done
   Fabrication 8/96
   Deployment 1/97
   Issues: Mercury recovery and monitoring

2. Process: Wastewater Evaporation
   Applicable Wastes: Secondary waste from other MTUs
   Estimated Volumes: Not estimated (this unit is generally intended to treat secondary waste streams from other MTUs)
   Feed Rate: 30gph
   Status: Design out for bid
   Fabrication out for bid
   Deployment 1/97
   Issues: None

3. Process: Lead Decontamination
   Applicable Wastes Surface contaminated lead
   Estimated Volumes: 84m^3
   Feed Rate: 0.14m^3 per 8-hr shift

	Status:	Design complete Fabrication complete Deployment complete, now in use & available
	Issues:	Irregular and complex geometries are difficult to decontaminate
4.	Process:	Mercury Amalgamation
	Applicable Wastes:	Liquid mercury
	Estimated Volumes:	571 liters
	Feed Rate:	2-4 liters per 8-hr shift
	Status:	Design in progress Fabrication complete 1/96 Deployment 9/96
	Issues	Volume expansion, chemistry, and mixing
5.	Process:	Packed Bed Reactor/Silent Discharge Plasma
	Applicable Wastes:	Organic liquids, polychlorinated biphenyls (PCBs), possibly sludges
	Estimated Volumes:	$26.48m^3$ (including $17.2m^3$ from Savannah River Site)
	Feed Rate:	0.65gph for organic liquids 3.15gph for 10% organic liquids
	Status:	Design concept complete Fabrication pending Deployment pending
	Issues:	Ash content is problematic for the packed bed, and coupling to the Silent Discharge Plasma unit has not been perfected
6.	Process	Macroencapsulation
	Applicable Wastes:	Lead and debris
	Estimated Volumes:	$882m^3$
	Feed Rate:	4 drums per 8-hr shift
	Status:	Design Request for Proposal (RFP) in process Fabrication complete 3/88 Deployment 7/99
	Issues:	Regulations concerning allowable void volume in final waste form

A basic premise of the MWTP is to utilize existing technologies to reduce DOE mixed waste inventories whenever possible. This has resulted in the use of commercial facilities, as well as current DOE capabilities to eliminate mixed waste. For example, a Sort, Survey, and Decontamination (SSD) team has been formed and used at Grand Junction to eliminate 80% of a waste stream previously identified as mixed waste. In addition, the SSD Team was able to verify that 90% of a suspect lead waste stream at ITRI was not contaminated. The SSD Team is also available to deploy to other sites to do the same work or to instruct others.

The SSD Team work is still in progress, and every effort is being made to utilize commercial treatment/processing capabilities, including contracts with Scientific Ecology Group (SEG) for

segregation/sorting, DSSI for burning of organic liquids, and Envirocare for disposal of soils. Due to these and other efforts, the Pinellas, ITRI, and SNL-CA sites are now compliant with all applicable Resource Conservation and Recovery Act (RCRA) requirements. Activities are ongoing to bring the Kansas City Plant and Grand Junction into compliance with RCRA also.

2.2 Day Two Activities

The second day at LANL began with some interesting presentations on current technology development and needs.

Mediated Electrochemical Oxidation (MEO) shows some promise for treating problematic waste streams which could lessen the more challenging design requirements placed on central waste treatment technologies. A process such as MEO could be used to treat small cyanide, PCBs, and mercury contaminated organic wastes. The current development plan includes treatability studies which may eliminate several such wastes. Cost-effectiveness and waste applicability data must be developed. In addition, definitive data must be developed for mediator metal reuse and substitution of non-RCRA regulated metals for the cobalt and cadmium presently used.

DOE-AOO has the need for nondestructive examination /nondestructive assay (NDE/NDA) for containerized heterogeneous waste, specifically transuranic (TRU) wastes, similar to most of the other major sites in the DOE complex. Mobile characterization capability is being developed at LANL for TRU wastes to save the costs of sample shipment. LANL has or is developing capabilities using a passive/active neutron (PAN) system, real time radiography, a segmented/tomographic gamma scan system, drum venting, drum coring, a characterization glovebox, headspace gas sampling, and a mobile analytical laboratory. Deployment of the mobile capability is estimated to save $760K per year based on collecting 200 samples per year. Development cost of this capability is estimated at $450K.

The controlled air incinerator (CAI) was originally built as a demonstration unit for incineration of TRU contaminated wastes. Constructed in 1973 and demonstrated hot from 1979-1987 on wastes containing PCP, fission products, ion exchange resins, and PCBs, the CAI was shut down in 1987 for upgrades to auxiliary systems. It received a Toxic Substance Control Act (TSCA) permit in 1984, which was renewed in 1992 for all DOE wastes, and a RCRA Part B permit limited to LANL wastes in 1989. The unit can handle solids, liquids, and slurries and is equipped with a spray quench, venturi scrubber, HEPA filtration activated carbon absorber, secondary HEPAs, and monitoring for NOx, THC, CO, and CO_2. Estimated treatment costs are $6/lb for solids, and $9/lb for chlorinated organic liquids. The unit is not running due to funding and resolution of NEPA documentation filed for system modifications. The Consent Order to be issued by the State of New Mexico under the FFCA is not expected to include the CAI.

2.3 Day Three Activities

As previously stated, the meeting on the morning of the final day of the MWFA visit to AOO was used to reiterate and discuss the path forward for the action items identified, as well as verify that the MWFA and the Albuquerque had a mutual understanding of these action items and recommendations. Because DOE-

AOO has purview over nine sites, a relatively substantial amount of information was exchanged during the previous two days, making this close out session essential. A copy of the cover sheet for all presentations given have been included in Appendix D. For complete copies of any of these presentations, please contact Jay Roach at 208-526-4974.

2.4 Recommendations by Albuquerque Personnel to the MWFA

The representatives from the AOO sites made recommendations that will allow the Focus Area to be more effective. The foremost recommendation made to the MWFA was that the efforts of the Focus Area should be directed at ensuring that actual mixed waste gets treated such that the DOE inventory is reduced. The comment was made that in the past too much effort may have been directed toward developing strategies and plans rather than actually treating waste. As a result, DOE has developed a reputation with the public of not being aggressive enough in its efforts to eliminate the waste in the complex. DOE Headquarters is attempting to improve this perception, accordingly, concerted effort by the MWFA to get the mixed waste inventory treated supports this initiative.

Another important recommendation provided was that the MWFA should be very active in coordinating its activities with those of other Focus Areas, National Programs, and Crosscutting Programs. Technology development budgets are limited and integration with these other programs is essential to prevent duplicative efforts. In addition, involvement by the MWFA with these programs will allow a consistent set of needs and requirements to be developed and communicated to the sites in the DOE complex.

2.5 Resulting Action Items

Several action items were identified for MWFA and Albuquerque personnel during the site meetings. These items are listed below. Any questions concerning the responsible persons for or status of any of these actions items should be addressed to Jay Roach at 208-526-4974 or Dirk Gombert at 208-526-4624.

1. The AOO has a need for capability to treat reactive materials, based on the current status of the MTU program. Some initial attempts have been made to get these wastes treated at the sodium treatment facilities at Argonne National Laboratory-West (ANL-W) without resolution. The MWFA recommended that Albuquerque personnel contact Bob Washburn at ANL-W to further investigate the possibility of treating some of these problematic waste streams at the INEL facilities rather than building a new treatment skid. Action: DOE-AL

2. AOO personnel have identified a near term need for a technical baseline that will match available DOE treatment capabilities, commercial treatment capabilities, and research and development activities to applicable waste streams. This need should be largely filled by the Needs Summary Report, to be published after the site visits are completed, which will allow the Waste Type Managers to establish their baseline technology strategies. Action: MWFA

3. A long term action item relates to organic waste streams located at SRS contaminated with significant amounts of tritium (i.e. 10,000 to 20,000 curies per drum). DOE-AL is proposing the Packed Bed

Reactor/Silent Discharge Plasma (PBR/SDP) as a treatment, which has been identified in the SRS Proposed Site Tratmetn Plan as the primary treatment option. However, based on the current schedule at SRS, this capability will not be needed until 2009. Tritium capture could be accomplished on molecular sieves or simply by complete condensation and stabilization in a grout. In addition, these wastes could possibly be blended with other lower activity wastes for treatment, or stored until the tritium decays to a much lower level. DOE-AL is proceeding with development of the PBR/SDP system, but needs to gather more information, with the help of the MWFA, concerning the real priority associated with the tritium contaminated wastes in the DOE complex. The appropriate technology development path must then be followed based on these findings. DOE-AL will make the tritium capture capability addition to the PBR/SDP unit if a need is identified. Action: DOE-AL.

4. The plating waste skid has been somewhat over-designed due to early estimates of volumes to be treated. In addition, small volume cyanide wastes, originally intended to be treated by this MTU, may potentially be destroyed in treatability tests of the mediated electrochemical oxidation process being developed at LANL. This further reduces the demands on the plating waste treatment process. A potential "quick win" for this waste was identified during the MWFA meetings at AOO. The Portable Water Treatment Unit (PWTU) operated at the INEL could possibly be moved to LANL to treat the remaining plating wastes without building a new MTU. The feasibility should be investigated further by the MWFA. Action: MWFA

5. A novel cold-plasma system utilizing carbon tetrafluoride (CF_4) to volatilize plutonium (Pu) contamination from debris to render the waste non-TRU was proposed by LANL personnel. This raised the question of whether the National TRU program or the Decontamination and Decommissioning Focus Area are conducting an evaluation of the state-of-the-art for decontamination of contaminated debris. With the costs of characterization and disposal escalating, particularly for TRU waste streams, development of a new means of decontamination should be evaluated for cost-effectiveness. These two organizations should be contacted and the plasma decontamination proposal should be presented to these organizations. Action: MWFA.

6. The Pantex representative proposed funding for using the plasma unit at Pacific Northwest Laboratory (PNL) for treatability studies on tritium contaminated weapon components, which are currently excluded from RCRA regulation, but will be classified as mixed waste if they are shredded. He will prepare a proposal for funding showing applicability of the data to the mixed waste inventory. Action: Pantex

7. The Pantex representative also proposed funding for a base hydrolysis process for treating high explosives as a backup for open burning. Though it was agreed that open burning will probably not be permitted indefinitely, and an alternative should be developed, this is probably a Defense Programs responsibility, and may well be commercially available. If the MWFA could be assured that the base hydrolysis process would be implemented at Pantex for mixed waste treatment, this activity might be supported. However, due to legal constraints related to ongoing litigation concerning this issue, this assurance is unlikely. Nevertheless, if there is adequate justification for support from the MWFA, a proposal will be prepared by Pantex. Action: Pantex

8. Copies of Value Engineering and working group reports, treatability studies on MEO and LTTD, and treatment concept analyses (i.e. evaluation of Delphi Detox) will be forwarded to the MWFA. In

addition, Results of studies performed by Rocky Flats Plant concerning macroencapsulation of high activity waste will be provided to the MWFA. Action: DOE-AL, Grand Junction.

3. SUMMARY OF ALBUQUERQUE SITE NEEDS

Several needs exist for the mixed waste inventory under the purview of DOE-AOO. Most of these issues are addressed by the MWTP and the MTUs. However, some unresolved issues still exist related to the waste streams intended for the MTUs. The significant outstanding needs associated with treatment/processing of the DOE-AOO mixed waste inventory are identified below:

1. High activity debris (activated lead) and organic streams.

2. PCB wastes.

3. Complex lead shapes with internal surfaces that cannot be grit blasted effectively.

4. Compressed gas cylinders, including both surface contamination and radioactive gases in damaged and unlabeled cylinders of all sizes.

5. Complex physical forms including pumps, a large magnet, and fluorescent tubes.

6. Accountable items such as weapon mock-ups.

7. Tritium and mercury bearing wastes. Stabilization, monitoring and capture of mercury and tritium are all of interest. The SNL-CA mercury monitor may have immediate applicability on the low temperature thermal desorption unit at Grand Junction.

8. NDE/NDA for radioactive and hazardous constituents in heterogeneous wastes.

Support is also requested from the MWFA to assist in identifying wastes to be treated in the uranium chips treatment and the lead decontamination MTUs.

4. ADDITIONAL RESEARCH, DEVELOPMENT, AND TREATABILITY STUDIES AT THE ALBUQUERQUE SITES

Time limitations of this site visit did not allow DOE-AOO to identify and describe all ongoing research, development, and treatability study activities at the nine sites under AOO's purview. However, two activities were presented to the MWFA including plasma decontamination of debris and polymer filtration.

The plasma cleaning process, developed by LANL, utilizes a CF_4 cold plasma to volatilize Pu contamination from debris. Surface TRU-contaminated glove boxes have been specifically identified as the waste stream for this process; however, some "quick wins" may exist for other problem wastes identified such as lead shapes and other parts with complex geometries.

The polymer filtration process, which is currently funded by the efficient separations crosscutting program, utilizes specially designed water-soluble polymers that selectively bond with the metal ions in the rinse bath. The advantages of this process are that it allows recovery of the plating metals for recycle into the electroplating bath and provides a high degree of metal ion selectivity. The polymers have such a large molecular weight that they can be physically separated using available ultrafiltration technology.

CONCLUSIONS AND RECOMMENDATIONS

The MWFA is very grateful for the extensive effort put forth by the DOE and contractor personnel at the Albuquerque facilities to organize this site visit The presentations given were informative, provided the data that the MWFA was seeking, and offered a fairly comprehensive view of the technology needs and issues facing the DOE-AOO sites. The MWFA sees many opportunities for potential “quick wins” and other near term and long term successes related to the activities at the AOO sites. To enhance these possibilities, the MWFA would like to gather more information related to planned treatability studies and demonstrations at the AOO sites. In addition, the Focus Area would like to identify ongoing and planned treatability studies at other sites that could possibly address some of the AOO mixed waste issues. Once again, the support provided by the AOO personnel is greatly appreciated. The MWFA looks forward to working with and supporting AOO in reducing its mixed waste inventory.

APPENDIX A
ALBUQUERQUE SITE MEETING AGENDA

(OMITTED)

APPENDIX B
LIST OF ATTENDEES

Mixed Waste Focus Area Meeting
Albuquerque Site Meeting
August 1, 1995

LIST OF ATTENDEES

Name	Organization	Phone	FAX
Phyllis Peterson	SNL-NM	505-848-0634	505-848-0999
Mauren Lincoln	SNL-NM	505-848-0944	505-848-0999
John Guth	SNL-NM	505-848-0912	505-848-0999
Jim Orban	DOE-AL WMD	505-845-4421	505-858-6286
Karen Douglas	DOE-AL ETDD	505-845-6411	505-845-4893
W. John Arthur	DOE-AL DEPM	505-845-6210	
Doug Denham	DOE-AL ETDD	505-845-4846	505-845-5960
Jay Roach	LMIT MWFA	208-526-4974	208-526-1061
Dave Eaton	LMIT MWFA	208-526-7002	208-526-1061
Jocelyn Buckley	DOE-AL ERD	505-845-4215	505-845-4239
Will Desmare	Pantex MH-SM	806-477-6744	
Robert Murphy	LANL CST-5	505-665-2630	505-665-3961
Ted Pietrok	DOE-KAO	505-845-5649	505-845-4710
Julie Conner	DOE-ID	208-526-0648	208-526-5964
Chris Houston	WMD-AL	505-845-5483	505-845-6286
John McFee	IT Corporation	505-262-8740	505-262-8855
Larry Bustard	SNL-NM	505-845-8661	505-844-1480
James Szenasi	DOE-AOO	505-845-4830	505-845-4665
Bruce Erdal	LANL EM/TD	505-667-8914	505-667-8118
Taz Bramlette	SNL-CA	510-294-2299	510-294-2999
Dirk Gombert	LMIT MWFA	208-526-4624	208-526-1061
George Rader	BRMD-AL	505-845-6189	505-845-4834

Name	Organization	Phone	FAX
Ron Nakaoka	LANL	505-665-5971	505-665-3750
Jay Farr	DOE-AL TSSC	505-845-5842	505-845-6158
Joel Grimm	DOE-AL WMD	505-845-5463	505-845-6286
Linda Hill	LANL EM/TD	505-224-9911	505-224-9920
Robert Griswold	DOE-AL ETDD	505-845-5573	505-845-4883
David Emilia	DOE-GJPO	970-248-6417	970-248-6040
Tami Toops	DPA-AL	505-845-5264	505-845-5398
Jeff Yokum	Pantex Batelle WM	806-477-5951	806-477-5954
Larbi Bounini	Rust GeoTech	970-248-7791	970-248-6040

Mixed Waste Focus Area Meeting
Albuquerque Site Meeting
August 2, 1995

LIST OF ATTENDEES

Name	Organization	Phone	FAX
Dennis Olona	LANL EM/TD	505-667-5338	
Ellen Stallings	LANL EM/TD	505-667-2236	
Guy Lussiez	LANL CST-18	505-667-7505	
David Curtis	LANL CST-27	505-667-7391	
Jacek Dziewinski	LANL CST-18	505-667-9792	
Melissa Miller	LANL EM/IPO	505-665-5377	
Leon Borduin	LANL TSA-11	505-667-3150	
Micheline Devaurs	LANL EM/WM	505-667-1519	
Syan Kosiewicz	LANL EM/WM	505-665-9227	
Kathy Elsberry	LANL CST-16	505-665-4686	
Jon Mack	DOE-LAAO	505-665-5026	
Jeanne Robinson	LANL CST-6	505-665-4843	
Barbara Smith	LANL CST-12	505-667-2391	
Bernard Foy	LANL CST-6	505-665-4835	

(Note: This list only includes the names of persons that did not attend the meeting on August 1, 1995 and were not on the previous list of attendees.)

APPENDIX C
STATUS, CAPABILITY, AND APPLICABILITY OF THE ALBUQUERQUE MOBILE TREATMENT UNITS

(OMITTED)

APPENDIX D
PRESENTATION COVER SHEETS

(OMITTED)

HANFORD SITE NEEDS TRIP REPORT

HANFORD SITE NEEDS TRIP REPORT
June 21-22, 1995

1. INTRODUCTION

Mixed Waste Focus Area (MWFA) personnel including Julie Conner, Kliss McNeel, Jay Roach, and Dirk Gombert met with Department of Energy-Richland (DOE-RL) and Westinghouse staff on June 21-22, 1995, at the Hanford Site to discuss plans for future mixed waste treatment and requirements that must be met to support their programs. The final meeting agenda and list of attendees are included as Appendix A and Appendix B, respectively.

2. EXTENDED AGENDA, RESULTING ACTION ITEMS, AND RECOMMENDATIONS

The first day of the Hanford Site visit began in the afternoon and included facility tours of several areas on the Hanford Site. The morning of the second day, the MWFA representatives were invited to attend the second meeting of the Site Technology Coordination Group (STCG) Mixed Waste Subcommittee, chaired by Joe Waring of DOE-RL, and composed of DOE-RL, Westinghouse, Environmental Protection Agency (EPA) Region 10, and Washington State Department of Ecology personnel. This subcommittee has been recently formed to collaboratively develop strategy with the MWFA to support the current tri-party agreement. The afternoon included presentations by Batelle Pacific Northwest Laboratories (PNL) on proposed research and development (R&D) tasks and a tour of the 324 Facility, which houses the PNL vitrification development laboratory.

2.1 Day One Activities

The MWFA team arrived at the Tri-cities on the afternoon of June 21, 1995. The MWFA visited several facilities at the Hanford Site. A tour by remote camera was provided of one of the canyon facilities, and stops were made at an outdoor sand-blasting vendor test and a facility established for characterization of alpha-contaminated shipments from off-site, which were adjacent to the canyon facility. Personnel at U.S. Ecology have encountered a high rate of waste drum shipments from some DOE sites which appear to be under-characterized or mislabeled. Costs for additional characterization are to be billed back to the originating facility.

The MWFA then visited the two new Resource Conservation and Recovery Act (RCRA) Subtitle C landfills being commissioned on the Hanford Reservation. These low-level waste (LLW) disposal trenches will be used to support ongoing Environmental Restoration (ER) activities, as well as provide the facilities to support the four-pronged management approach that Hanford has developed for the mixed wastes generated at the Site. This methodology includes provisions for: a) wastes that require commercial treatment, b) wastes that require commercial treatment and stabilization, c) special waste forms (i.e. batteries, previously stabilized wastes, etc.), and d) wastes that can be disposed by petition. The Hanford

personnel believe that this strategy will provide for treatment to Land Disposal Restriction (LDR) standards for all applicable wastes and allow disposal of some untreated waste streams through petitioning for RCRA waivers.

The "Mega-trench", to be sited in the Hanford 200-area, will be a similar design, but will be much larger (one square mile), and dedicated to environmental restoration, remediation, and decontamination and decommissioning (D&D) wastes only. Interestingly, the projected unit disposal costs for RCRA compliant disposal is competitive with the current charges for LLW disposal at the U.S. Ecology facility on the Hanford Reservation.

2.2 Day Two Activities

The second day began with an introduction to the Hanford STCG and their overall strategy of privatization. The general treatment approach at Hanford is directed by the tank remediation program. The single shelled tank contents will be transferred to the double shelled tanks, the waste will be partitioned into high-level/transuranic (TRU) waste streams and LLW streams, and both streams will be vitrified, with the former destined for an off-site repository, and the latter disposed on-site in the trenches mentioned above. Other LLW will be decontaminated and/or partitioned to feed into one of these two processes.

Most of the facilities proposed to perform these processes on the Hanford waste are assumed to be constructed and operated by a commercial vendor, as previously mentioned. The criteria on which the vendors will develop bids for most facilities has not yet been developed. A Request for Proposals (RFP) has been issued by DOE-RL for a new thermal treatment facility to treat mixed waste, but the strategy is hampered by government procurement restrictions that preclude encumbering funds from future years. Nevertheless, proposals have been received in response to this RFP, and the selection process is ongoing. Another RFP for a stabilization facility [privatization of part of the Waste Receiving and Processing (WRAP-2A) facility] is planned with potential funding of $1M in FY-2000 and $4.2M in FY-2001.

Detailed discussions on technology needs or specific treatment requirements were not entered into due to the relatively recent formation of the STCG, and their intended strategy of allowing vendors to propose treatment systems. However, the Hanford STCG has identified two summary needs: a) treatment for wastes containing alpha-contaminated polychlorinated biphenyls (PCBs), lead, and mercury; and 2) instrumentation for real-time characterization of waste in containers, both in situ and in-process.

The Hanford STCG has also developed a Rapid Deployment Initiative (RDI), in support of congressional requests. The RDI intends to deploy selected technologies by the end of July, and demonstrate progress in the following eight months. Technologies currently being evaluated by the STCG include the Corpex Nuclear Decon Process, an asbestos mineralogical conversion process, a method for coupling sonic drilling with in situ characterization, and electrokinetic remediation of soil in situ. These activities generally support ER and D&D activities.

In addition, Hanford personnel pointed out the need for "implementation demonstrations" or, in other words, practical on-site tests, which use the actual mixed wastes that will be treated, to demonstrate that the technology will work in the site-specific environment. The Management and Operations contractor

must perceive a benefit to trying an innovative technology that could perform better or at less cost. At present, the risk of failure apparently surpasses the reward for deploying a potentially more cost-effective technology. This is similar to the analysis the EPA has published for the slow acceptance of innovative concepts in Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) projects. Vendors are also growing impatient with DOE requests for more demonstrations with no commitment for follow-on work if the demonstration is successful. Suggestions indicated that a procurement process similar in structure to the Pit 9 project may be beneficial to the Hanford situation. An RFP can include in its scope both a proof-of-principle test, and full deployment based on successful testing. In this manner, the vendor can lock in a market, but the DOE is protected by a performance based contract.

An overview of the MWFA organization was presented by Julie Conners. Joe Waring was identified as the MWFA's main point-of-contact for the Hanford Reservation during this discussion. Mr. Waring agreed to pursue the following list of information for the MWFA by July 21, 1995:

2.2.1. Treatment criteria to be used in planned Richland RFPs.

2.2.2. A list of selected Environmental Restoration and Waste Mangement (EM-30/40) funded technologies in which Richland has particular interest.

2.2.3. A summary or copies of completed Richland sponsored technology, treatability studies, or vendor evaluations.

2.2.4 Information on Richland supported R&D.

2.2.5 EPA-Region/State specific treatment requirements.

The afternoon session was dedicated to an overview by PNL researchers on current or proposed technologies including the submerged bed scrubber, a DC arc melter, and others. Hard copies were provided for some of the presentations that were given and the title sheets of these have been included in Appendix C for reference. Complete copies of these presentations are available from Jay Roach at 208-526-4974, upon request.

The submerged bed scrubber is a novel bubbler design with reduced dependence on moving parts, which may be advantageous for remote environments. The trade-off for this benefit is a relatively large footprint, and somewhat less efficiency compared to a venturi scrubber.

The DC-arc melter work presented by Jeff Surma uses a submerged arc that should reduce heat loss, refractory corrosion, and particle carryover into the offgas relative to above-melt plasma designs. Mr. Surma's work is not integrated with the Clemson/Massachusetts Institute of Technology (MIT) work supported by Savannah River Site (SRS) and the Landfill Focus Area, and continuation of his work is threatened by loss of funding from that focus area.

Proposed work on modeling long-term durability of plasma and joule-heated melter products, developing ternary diagrams for waste melting operations, and a novel process for melting wastes in vessels placed in below-ground excavations was also presented. Some of these proposals were already evaluated in the FY-

1996 Technical Task Plan (TTP) prioritization process.

Finally, a short tour was provided of the 324 Facility, including the PNL vitrification development laboratory. This facility contains several melter designs as well as the submerged bed scrubber. A high-temperature joule-heated melter using conductive refractory wall electrodes was in operation at the time of the MWFA visit.

2.3 Recommendations by Hanford Personnel to the MWFA

Though specific site needs could not yet be discussed in detail, Hanford personnel endorsed the MWFA approach of using site visits as a method to develop criteria to build a systems evaluation for a treatment strategy. The proposed combined testing/performance-based contract to address the need for "implementation demonstrations" also seemed to be readily accepted, though funding will continue to be an issue. The "bake-off" concept to provide comparable data from vendors of competing technologies was also strongly endorsed, and Joe Waring agreed to provide data from treatability and other studies performed at Hanford, to date. In addition, Mr. Waring will provide input to the MWFA on the type of data needed from future tests.

3. SUMMARY OF HANFORD SITE NEEDS

As previously mentioned, specific needs were not identified by Hanford that the MWFA could support at this time. The summary needs listed in Section 2.2 above are planned to be addressed by the vendors that respond to the RFPs that are issued. As the discussions with Hanford personnel indicate, similar needs to those identified for the Idaho National Engineering Laboratory (INEL) and SRS sites exist for this site, but specifics must be determined from information to be transmitted from Richland in the near future. The primary role of the MWFA will probably be to provide data to support development of future RFPs and evaluations of commercial vendor bids.

4. ADDITIONAL RESEARCH DEVELOPMENT, AND TREATABILITY STUDIES AT HANFORD

Details are forthcoming, however, a planned vendor test at Hanford apparently may build on some proprietary decontamination technology testing already conducted at the INEL. This will be investigated further through the Hanford point-of-contact.

5. CONCLUSIONS AND RECOMMENDATIONS

Based on the information gathered during the Hanford Site visit by the MWFA, the following recommendations are provided.

1. The STCG Mixed Waste Subcommittee at Hanford is now in an embryonic form, and development

could potentially be accelerated by collaboration with other sites. The MWFA should facilitate this interaction if possible.

2 In reply to the Hanford request for a solution to the "implementation demonstration" dilemma, the MWFA should aggressively pursue a test case for an RFP combining proof of principle testing with a performance-based contract for treating waste. This strategy mirrors the Pit 9 procurement, and is not unlike the strategy currently in use at Oak Ridge National Laboratory to vitrify some process sludges.

3. Research on the DC-arc melter of the type conducted by Jeff Surma should be continued. If this effort is not supported by the Landfill Focus Area, it should be evaluated with the proposals from SRS, Clemson, and MIT and an integrated program using the best talent should be funded by the MWFA. This may require a face-to-face meeting with the Principle Investigators and independent review facilitated by the Technical Resource Team.

The MWFA looks forward to getting more information from Hanford to better define its support scope for that Site.

APPENDIX A
HANFORD SITE MEETING AGENDA

(OMITTED)

APPENDIX B
LIST OF ATTENDEES

Mixed Waste Focus Area/Hanford STCG Mixed Waste Subcommittee Meeting
June 21 - 22, 1995

LIST OF ATTENDEES

Name	Organization	Phone
Joe Waring	DOE-RL/WPD	509-373-7687
Mike Coony	WHC/SWP	509-376-9774
Dale Black	WHC/PD	509-376-8458
Steve Weakly	PNL	509-372-4275
Kliss McNeel	LMIT/MWFA	208-526-7925
Rick Gonzalez	TPD/RL	509-373-9922
Nancy Uziemblo	Ecology	509-736-3014
Greg Thomas	Dames & Moore	509-372-4027
Pamela Innis	EPA	509-376-4919
Jay Roach	LMIT/MWFA	208-526-4974
Shannon Runyon	DOE-RL TDD	509-372-4029
Moses Javangsi	WDOE Ecology	509-736-3016
Becky Bechtold	WHC - Tech Integration	509-376-9017
Dirk Gombert	LMIT/MWFA	208-526-4624
Paul MacBeth	Dames & Moore/ GSSC	509-372-2289
Salem Farooqui	Dames & Moore/ GSSC	509-372-4023
Wayne Ross	PNL	509-372-4684
Steve Mech	WHC SATP	509-376-8858
Jim Duncan	WHC SATP	509-372-0896
Julie Conner	DOE-ID/MWFA	208-526-0648

APPENDIX C
PRESENTATION COVER SHEETS

(OMITTED)

IDAHO NATIONAL ENGINEERING LABORATORY NEEDS TRIP REPORT

IDAHO NATIONAL ENGINEERING LABORATORY NEEDS TRIP REPORT

1. INTRODUCTION

Representatives from the Mixed Waste Focus Area (MWFA) met with Department of Energy (DOE) and contractor representatives from EM-30, 40, and 60 at the Idaho National Engineering Laboratory (INEL) throughout the month of May, 1995. Several small, informal meetings were scheduled by the MWFA with key EM-30, 40, and 60 personnel at DOE and the contractor. The purpose of these meetings was to begin defining the technology development needs of the INEL. Since these initial meetings at the INEL, the MWFA has visited several sites. Information provided by other sites indicates that the MWFA needs to document data on treatability studies and demonstrations at the INEL. In addition, potential utilization of capabilities at other sites should be explored. This additional information is essential for the MWFA to develop a complex-wide integrated program. The needed data will be collected as the integrated technical baseline for the MWFA is developed and refined.

2. IDENTIFIED TECHNOLOGY DEVELOPMENT NEEDS AT THE IDAHO NATIONAL ENGINEERING LABORATORY

The meetings that the MWFA scheduled with INEL personnel were completed throughout the month of May, 1995. These meetings were informal and the attendees varied from meeting to meeting. The MWFA met with DOE and Lockheed Martin Idaho Technologies (LMIT) contractor managers for EM-30, 40, and 60 separately. The INEL personnel involved were as follows:

Name	Organization	Division
Joel Case	DOE-ID	EM-30 Waste Management
Kathy Falconer	LMIT	Environmental Restoration
Lisa Green	DOE-ID	EM-40 Environmental Restoration
Jim VanVliet	LMIT	Waste Management
Alice Williams	DOE-ID	EM-60 Facility Transition, Decontamination and Decommissioning

2.1. Waste Management Needs

Several needs were identified by the Waste Management (WM) personnel at the INEL. Some of these needs include activities that other Focus Areas and Crosscutting Programs are currently addressing. Consequently, the MWFA efforts in these target areas will have to be integrated with the applicable programs. The WM needs provided to the MWFA are listed below.

1. Remote equipment to provide Resource Conservation and Recovery Act (RCRA) inspection of contact-handled (CH) and remote-handled (RH) waste drums and to reduce radiation exposure to workers. This work requires integration with the Robotics Crosscutting Program.

2. Moisture restrictive drum venting filters that will allow drums to be vented while preventing moisture from entering the drum. This will prevent condensate formation in the drums and reduce corrosion.

3. A drum refurbishment system that can repair suspect CH mixed transuranic (MTRU) waste drums to Department of Transportation (DOT) Type A requirements. This would increase the life of the drums, reduce overpacking, reduce costs, and reduce worker exposure.

4. A corrosion-proof container and overpack system for CH and RH MTRU waste that will be in long term (50 years) storage. The container and overpack system should meet DOT standards, as well as provide long term resistance to corrosion and degradation from external and internal environments, including high radioactivity.

5. Nondestructive examination and nondestructive assay (NDE/NDA) performance demonstrations for MTRU waste in drums is required to assess application and potential implementation at the Stored Waste Examination Pilot Plant (SWEPP). These activities would require coordination with the Characterization, Monitors, and Sensor Technology (CMST) Crosscutting Program and Landfill Focus Area.

6. Assay capability for MTRU waste boxes is required to reduce repackaging, which lowers cost and worker exposure. Current commercial and government capabilities should be evaluated. These activities would require coordination with the Characterization, Monitor, and Sensor Technology (CMST) Crosscutting Program and Landfill Focus Area.

7. Mobile drum venting and gas sampling/analysis equipment to characterize waste drums in the field. The configuration should be flexible to allow access to vaults and similar hard-to-reach areas, which is typical of RH waste storage locations.

8. A waste box overpack, that is DOT approved, for field installation during retrieval operations. This would reduce sizing and repackaging prior to storage.

9. Surrogate wastes for MTRU waste forms must be developed to support treatment demonstrations of planned treatment units such as the Pit 9 Demonstration Project, as well as other alternatives for treatment of alpha-contaminated wastes.

10. A DOT approved box transport system for MTRU waste boxes. The required design, development, and DOT testing must be completed as part of the scope of this effort. MWFA support for this effort would have to be coordinated with the National TRU Program.

11. A solid waste mixer and extruder-feeder system for installation onto a top vertical-fed high temperature carbon arc furnace (i.e. the DC arc melter being developed by Pacific Northwest

Laboratory at Hanford). This system is necessary to remotely condition heterogeneous waste streams such as metals, combustibles, sludges, concrete, cloth, paper, and plastics. This work will have to be coordinated with the Landfill Focus Area and the Robotics Crosscutting Program.

12. A remote melter tapping mechanism to separate and remove the slag and metal secondary streams from high temperature furnaces. This capability is necessary for handling the residuals generated during treatment of radioactive waste streams. MWFA support for this work would be integrated with the Robotics Crosscutting Program.

13. Development and demonstration of offgas monitoring equipment and systems for thermal treatment processes. This work will be coordinated with the CMST Crosscutting Program, as well as ongoing efforts at the Savannah River and Oak Ridge sites.

14. Capability to remove NOx, SOx, and hazardous hydrocarbons from offgas. The technology proposed by the INEL is cermet filters. Cermet is processed ceramic particles that are bonded with a metal. This work will be coordinated with the CMST program and other development efforts throughout the DOE complex (i.e. silent discharge plasma technology at Los Alamos National Laboratory).

15. Decontamination capability of volume contaminated lead sheets, bricks, shot, and other miscellaneous that are in storage at various facilities at the INEL. Decontamination capability should include radioactive and hazardous constituents. The only currently available option is macroencapsulation, which is a waste of a usable material.

2.2 Environmental Restoration Needs

The main need for Environmental Restoration (ER) is that the data developed in the ongoing and planned treatability studies and demonstrations meet the requirements for Feasibility Studies (FS) conducted within the framework of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Historically, technology development reports have not been in a format that supports the CERCLA FS process. Ensuring that the resulting reports from treatment demonstrations and studies meet the CERCLA requirements will allow them to be used as data appendices for FS reports. This will provide an integrated and cost-effective link between WM and ER activities.

In addition to this overriding need, other needs exist for the waste streams that are projected to be generated by the ER activities. The primary generation of ER wastes will be from remediation of the tanks at the INEL. Six tanks and one septic field, which contains three septic tanks and a seepage pit, will be remediated at the INEL. These tanks contain approximately 11,900 gallons of clear liquid waste, 410 gallons of sludges/slurries, and 13,900 gallons of soils/sand with absorbed sludges. These tanks have been sampled and found to contain polychlorinated biphenyls (PCBs), RCRA metals, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). Consequently, treatment and stabilization capabilities will be required to bring these materials into compliance with RCRA, including Land Disposal Restrictions (LDRs) and Toxicity Characteristic Leaching Procedure (TCLP) requirements. Detailed data related to the specific hazardous and radioactive constituents identified in the tanks has been provided to the MWFA and can be obtained from Jay Roach at 208-526-4974.

2.3 Facility Transition/Decontamination and Decommissioning Needs

At the present time, specific needs have not been identified for Facility Transition/Decontamination and Decommissioning (D&D) activities. However, the MWFA is interested in evaluating the applicability for a new surface decontamination technology being developed at Los Alamos National Laboratory. The process uses carbon tetraflouride as a cold plasma to decontaminate complex shapes such as glove boxes containing plutonium. This technology is still in the development and testing phase. Support provided to this work by the MWFA would be based on an identified need from the EM-60 customers.

3. ADDITIONAL RESEARCH, DEVELOPMENT, AND TECHNOLOGY STUDIES AT THE INEL

In addition to the needs documented above, the INEL WM program has identified several technology development efforts for consideration. These activities include development of cermet filters, a radiant hot wall packed bed secondary combustion system, and a steam reforming arc furnace. In addition, WM would like to provide installation, testing and evaluation of an industry-developed improved twin-torch system for the plasma hearth process.

Cermet is a porous catalytic high temperature material produced by bonding processed ceramic particles with metal. Cermet filters can provide effective removal of NOx, SOx, and hazardous hydrocarbons from offgases. The scope of the effort would include bench and pilot scale testing over a three period. Estimated costs would be $400K in FY-1996, $750K in FY-1997, and $1,500K in FY-1998.

Another technology proposed to control offgases is the radiant hot wall packed bed secondary combustion system. This process uses an electrically heated radiant hot wall, which is a high temperature resistive heating element shaped into a tube, with an electrically insulated low pressure drop porous catalytic packed bed. This system is configured as a secondary combustion chamber for final combustion of the offgases from a thermal treatment process. This effort should be coordinated with Los Alamos National Laboratory, which is developing a mobile treatment unit (MTU) that contains a packed bed reactor with a silent discharge plasma unit for NOx, products of incomplete combustion (PICs), and dioxin/furan elimination. Although the unit at Los Alamos is being developed to treat waste, the data collected during development could probably be used to identify the potential for use of this MTU technology on INEL wastes. The proposed scope of the effort would include bench and pilot scale testing over a three year period. Estimated costs would be $400K in FY-1996, $750K in FY-1997, and $1,500K in FY-1998.

WM is also interested in developing a steam reforming arc furnace. Application of steam reforming within an electric furnace is relatively new and not much data exists on this process. The applicability and effectiveness of this technology in relation to other technologies presently available or in development throughout the DOE complex would have to be investigated. The proposed scope of the effort would include bench scale testing over a three year period. Estimated costs would be $450K in FY-1996, $750K in FY-1997, and $2,000K in FY-1998.

The torch life for the plasma hearth process is presently at about 100 hours, which is a severe, impractical limitation to this technology. A twin-torch configuration is being developed through an industrial partnership, as part of the SBIR program. This new design is projected to have a torch life of around 1,000 hours. The scope of this effort at the INEL would include evaluation of hardware performance as a function of various process conditions. The project is estimated to last approximately 18 months at a cost of $900K. This need must be coordinated with the torch evaluations planned to be conducted at MSE, Inc.

Previous research has been done on the effects of adding oxygen enrichment systems to controlled air incinerators. The initial efforts, which were done in support of implementation of DOE Order 5820.2A, evaluated the capability of oxygen enrighment to increase processing rates. Follow-on research was completed to study the effects of oxygen enrichment in reducing the formation of PICs (i.e. dioxin/furan) in the offgas. These studies yielded positive results and the next logical step is to install an oxygen enrichment system on an operating incinerator. The INEL is proposing to install such a system on the controlled air incinerator at the Waste Experimental Reduction Facility (WERF). Low-level waste is currently being processed in the WERF incinerator and treatment of mixed waste is expected to start during the first quarter of FY-1996. This work, if initiated, will have to be integrated with the ongoing treatment activities at WERF.

4. CONCLUSION

The INEL was used as a test case for establishing a procedure to obtain the technology needs information from the major DOE sites in the complex. As previously stated, the data was gathered through several small, informal meetings with key personnel. Experience has shown that more complete information can be obtained when all the customers are brought together in the same room to discuss the site needs. This provides a more integrated, comprehensive picture of the actual “needs” that exist at a site.

Standard questions have been developed that ensure that the MWFA is collecting the right information from the sites. In addition, more extensive data is gathered on applicable technologies at other sites, ongoing and planned treatability studies, and potential “quick wins”. These elements are essential to establishing an integrated technical baseline, which will determine the DOE complex technology development activities.

The information and support provided to the MWFA is greatly appreciated. The Focus Area is looking forward to meeting with INEL personnel through interaction with the Waste Type Managers to further define, expand, and refine the INEL technology development needs and planned activities.

OAK RIDGE RESERVATION NEEDS TRIP REPORT

OAK RIDGE RESERVATION NEEDS TRIP REPORT
August 22 - 23, 1995

1. INTRODUCTION

On August 22 - 23, 1995, representatives from the Mixed Waste Focus Area (MWFA) met with Department of Energy (DOE) and contractor representatives from sites under the purview of DOE-Oak Ridge Operations (DOE-ORO) to discuss their needs for technology development and regulatory support, as well as their potential treatment capabilities for mixed waste. Personnel from the MWFA included Julie Conner, Jay Roach, Dave Eaton and Dirk Gombert. The sites represented included Oak Ridge National Laboratory (ORNL), Oak Ridge K-25 Plant, Oak Ridge Y-12 Plant, and the Paducah Gaseous Diffusion Plant (PGDP). The meeting agenda and list of attendees are included as Appendix A and Appendix B, respectively.

2. EXTENDED AGENDA, RESULTING ACTION ITEMS, AND RECOMMENDATIONS

The first day of the visit to the Oak Ridge Reservation (ORR) consisted of meetings with EM-30, 40, and 50 personnel in which the technology development needs, regulatory status, and ongoing technology development projects were presented to the MWFA. The second day included tours of specific facilities at the ORNL, the K-25 Plant, and the Y-12 Plant.

2.1 Day One Activities

The MWFA met with DOE and contractor personnel at ORR for one full day on August 22, 1995. Presentations were given describing the Oak Ridge Site Technology Coordination Group (STCG), EM-30 and EM-40 technology development needs, status of the Oak Ridge privatization initiatives, and the status of ongoing EM-50 technology demonstration projects. Cover sheets from all presentations given have been included in Appendix C for reference. For complete copies or more information related to these presentations please contact Jay Roach at 208-526-4974.

The STCG at ORR is well established and active in assessing and prioritizing the technology needs at ORR. The ORR STCG includes members from environmental restoration, waste management, technology development, the DOE field office, the contractor, regulatory agencies, stakeholder groups, and academia. Six technical subgroups have been established within the STCG, including Mercury, Buried Wastes, Plumes, Tanks, Decontamination and Decommissioning, and Mixed Waste. These subgroups generally support the five focus areas established by DOE-HQ. However, the Mercury Subgroup has been established separately due to the unique problem associated with mercury contaminated wastes at ORR. Almost 60%, approximately 96m^3, of the DOE complex mercury and mercury-contaminated waste is located at the sites under the purview of DOE-ORO, including PGDP. The MWFA will continue to work with the ORR STCG representatives to improve communications between ORR, the focus area, and

technology development projects that support ORR needs. A complete listing of the Oak Ridge STCG membership has been provided in Appendix D for reference.

Information was provided to the MWFA concerning the EM-30 and EM-40 priorities and associated technology development needs at ORR. The priorities for the ORR mixed wastes, as established by the State of Tennessee, are listed below. The specific technology development needs associated with these priorities, as well as other needs, are discussed in Section 3. The waste management priorities for ORR are as follows:

1. Incineration of liquids and solids in the Toxic Substance Control Act (TSCA) Incinerator
2. Treatment of explosives and compressed gases
3. Remote-handled transuranic (RH-TRU) waste sludge (this priority is being addressed by the Tanks Focus Area)
4. Treatment of Aqueous liquids
5. Stabilization of West End Treatment Facility (WETF) sludge (the resolution of this priority is being commercialized)
6. Unstabilized pond sludge [proposed as part of the Transportable Vitrification System (TVS) demonstration]
7. DO18-DO43 debris (toxic characteristic organics)
8. TSCA residuals
9. Stabilization of inorganics
10. Vitrification demonstration wastes (this priority is being addressed through various commercial and ongoing technology development activities).

The ORR personnel presented information pertaining to the privatization efforts at Oak Ridge also. Currently, private sector treatment of 85% of the mixed waste inventory under the purview of ORO is being pursued through various efforts. Commercial capabilities being used, or pursued, include disposal of mixed waste at Envirocare; recycling of intact fluorescent bulbs; treatment and disposal of WETF sludge, unstabilized pond waste, and scintillation cocktails; and TRU waste treatment. In addition, a new broad spectrum procurement process has been initiated for a variety of waste streams, including soils, sludges, debris, metals, lab packs, batteries, and compressed gas containers. Mixed waste from other sites could potentially be included in the broad spectrum procurement. Awarding the broad spectrum procurement contract is a phased process. Based on initial responses, two vendors will be selected through issuance of a Request for Proposal (RFP) in Phase 1 to treat up to 100,000 kg from at least three of the waste streams. The RFP is expected to be issued in October 1995 and the Phase I contracts will be awarded around April 1996. Based on the demonstrations, a single contract will be awarded for Phase II,

expected to be issued around May 1997, for a guaranteed minimum amount of waste. As currently planned, the broad spectrum procurement will address 6,500,000 kg of Oak Ridge mixed waste.

Additional privatization activities were identified at ORR related to Environmental Restoration (ER) wastes. The five-year projections for ER soils/sludges have been estimated at 1,800,000 ft^3 of solid material and 500,000,000 ft^3 of liquid waste. An announcement in Commerce Business Daily was issued in June 1995, and an RFP is expected to be submitted in September 1995.

Oak Ridge also has a very aggressive metal recycle program. Estimates indicate that approximately 720,000 tons of stainless steel with 60,000 tons of nickel can be salvaged from the gaseous diffusion plants under the purview of ORO. The metal can be recycled for use as radioactive waste disposal containers. The question related to potential free-release of these materials must still be resolved.

During the MWFA visit to ORR, some of the ongoing technology development activities were statused, including the TVS and the Vortec Vitrification Demonstration. Other technology development activities are ongoing at ORR, some of which were presented on Day Two during the Site visit, and are discussed in the Section 2.2.

The TVS has passed a system checkout at the vendor's facility in Irwin, TN. The system is being dismantled for shipment to the Clemson Technical Center where it will undergo surrogate testing before being sent to Oak Ridge for demonstration on B&C pond sludge. No issues remain for the completion of this demonstration, but some questions exist concerning the disposition of the TVS after the demonstration is complete. Oak Ridge and the State of Tennessee would like to continue to use the TVS for large treatability studies on "more difficult" waste streams, with substantial co-funding from EM-30. The State of Tennessee does not want to see substantial ORR EM-30 funds diverted to development of a treatment system that is only going to be used on a relatively small, low-risk volume of waste. The owner of the TVS, Savannah River, has indicated that this equipment is mobile and could be used at other sites after the demonstration at Oak Ridge. Whatever ultimately happens with the TVS will have to be coordinated between Oak Ridge, Savannah River, and the appropriate state regulatory agencies. Modifications to the feed system and to the offgas system are also being contemplated. Funding for all these activities remains to be established.

The Vortec Vitrification Demonstration at PGDP was also discussed. Paducah has about 1,000 m^3 of mixed waste, 60% of which does not currently have a treatment specified. This waste volume consists of two primary streams: 1) metal containers of ash from the diffusion process (the ash has bonded itself to the containers over time through the effects of seasonal temperature cycling) and 2) miscellaneous heterogeneous debris. PGDP has initiated a $12,000,000 demonstration project through Morgantown Energy Technology Center (METC) of a vitrification system from Vortec Corporation, which uses a gas fired melter with co-firing of waste and glass formers through the burner. The resulting glass is water quenched, producing a granular glass frit. The Vortec process cannot process metals, so the waste must be separated from the drums. A primary need for both of the streams planned for the Vortec system is separation and nondestructive characterization. The system, which has been developed for use in commercial applications, is a 25 ton/day system and is scheduled for installation at Paducah, in July 1996. However, the drum feed/separation system that has been designed, must still be tested and demonstrated.

2.2 Day Two Activities

The second day of the MWFA visit to ORR included a tour of several facilities at ORNL and the Y-12 and K-25 Plants. Treatment facilities, demonstration laboratories, as well as research laboratories were included in the tour.

The primary facility visited at the K-25 site was the TSCA incinerator. One of the most important findings from the Oak Ridge visit is that the TSCA incinerator can, and does, process solids. A misconception exists throughout much of the DOE complex that this facility would require feed modifications to process solids. During this visit, the MWFA was informed that the TSCA incinerator is permitted to burn solids, in addition to liquids, and recently completed a successful trial burn for its permit. The current capacity for processing solid materials is about one million pounds per year. Historically, this facility has processed liquids almost exclusively, in agreement with the state of Tennessee, because liquids are perceived as a more immediate and higher risk concern for ORR. However, current liquid inventories should be worked off in FY96, after which solids will be routinely processed at the TSCA incinerator. The State of Tennessee appears willing to accept waste from other States for treatment, including solid materials, provided that residuals return to the State of origin, that the treatment schedules for ORR wastes are not adversely affected, and that equity issues are resolved. If any changes to the feed system are incorporated, these modifications will be based on the future solid feed quantities and as required by the 1997 permit renewal. Potential upgrades to the offgas system are also being considered. These modifications may be required to meet the proposed new particulate emission regulations that may be promulgated by the EPA Combustion Ruling. The final level of control required, which may exceed the capability of the current system, has not yet been determined.

Several facilities were visited at ORNL, including the Waste Examination and Assay Facility (WEAF), an In Situ Vitrification (ISV) treatment site, the Vitrification Laboratory, and the Mercury Removal Laboratory. The ongoing activities associated with Pulsed Fast Thermal Neutron (PFTN) Analysis were discussed and a demonstration was given at WEAF. This technology may have the capability to perform nondestructive assay of a drum. The ISV project visited by the MWFA will stabilize the first of several inactive disposal pits at ORR, based on the success of the initial work. The Vitrification Laboratory at ORNL supports the TVS project, as well as other vitrification activities, with basic research on glass composition limits and ternary diagram definition. Some critical data concerning sodium/lithium limits and corrosion properties of the final waste form have been developed here.

The final stop on the tour of ORNL was the Mercury Removal Laboratory. Mercury removal processes, which use KI/I_2, for contaminated debris and other waste forms have been successfully demonstrated through the research, development, and experimentation conducted in this laboratory. Further development is ongoing.

The West End Treatment Facility was toured at the Y-12 Plant. Treatment residues from this facility are a major source of mixed waste at ORR that must be treated for Resource Conservation and Recovery Act (RCRA) compliance. WETF is a primary water treatment facility and will continue to generate waste sludge.

2.3 Recommendations by Oak Ridge Personnel to the MWFA

The major recommendation provided by the Oak Ridge personnel to the MWFA was related to the integration between the five Focus Areas that have been established by DOE. The site visits, data requests, and general coordination between the Focus Areas are not integrated well. This places excessive burden on the sites and field offices to support all of the requests from the Focus Areas. Oak Ridge contractor and DOE personnel believe that the communication and planning between the Focus Areas is inadequate. The Mixed Waste Focus Area has been assigned an action item to address this issue.

Another recommendation to the MWFA from ORO was that the interaction between the Focus Area and ORR should be closely coordinated with the STCG. This body is intimately involved with needs assessment, strategic planning, and technology development activities at ORR. To ensure that MWFA actions do not adversely effect any ongoing or planned activities at ORR related to mixed waste, the Focus Area must work with the STCG. The MWFA supports this request and plans to coordinate all future activities with the ORO STCG.

2.4 Resulting Action Items

Some action items were assigned as a result of the MWFA meetings with ORR personnel. These actions are listed below.

1. The MWFA needs to establish better integration and communication with the other Focus Areas. A MWFA is attempting to set up a meeting between Focus Area leads to discussion integration between the groups. The resulting decisions will be distributed to all sites.

2. The MWFA needs to develop a defensible prioritization/selection process for determining which technology development activities are supported by the Focus Area. The Waste Type Teams, in conjunction with the Technical Resource Team, are presently in the process of developing this system.

3. Several in-depth needs assessments for ORR have been completed since 1989. These reports may be accessible on the Internet by the end of the year. If this happens, ORR personnel will provide the information to the MWFA to access these reports. But, whether these assessments become available on Internet or not, ORR personnel will provide this data to the MWFA.

3. SUMMARY OF OAK RIDGE RESERVATION NEEDS

As previously stated, a priority list of activities has been developed for management of the mixed waste by ORR personnel, in consultation with the State of Tennessee. Several technology development needs exist relative to this list. Based on this information, ORR has established a set of priority “unmet technology needs”. These needs are as follows:

1. Compressed gas cylinder disposal (this is a potential quick win for the gas cylinder mobile treatment unit that the Albuquerque Operations Office has developed)

2. Thermal desorption bench scale studies (this need is related to D018 - D043 wastes)

3. Comparison studies between grouting and macroencapsulation (this need is related to TSCA residuals and stabilization of inorganic wastes)

4. Improved material handling (sorting and segregation) and storage containers (especially pressurized drums)

5. Improved separation of RCRA and radioactive metals, nitrates, and lithium from waste waters; improved monitoring of RCRA metals in discharge water; and potential stabilization of the residuals (this need is related to treatment of aqueous liquids).

In addition, some lower priority unmet technology needs have been identified. These include the following:

1. Detection of low level radioactivity in discarded chemicals

2. Long-term performance assessment of waste forms

3. Transportable chemical oxidation unit

4. Separation of nickel from electroplating solution and vitrification wastes.

In addition to the needs defined above, other needs were identified at various times during the MWFA visit to ORR. These needs include the following items:

1. Mercury recovery (as previously stated, ORR has the majority of the mercury contaminated waste in the DOE complex)

2. Nondestructive examination/assay of drummed waste (current plans include having commercial entities characterize ORR waste at the site)

3. Separations technology for photographic wastes (this is a potential quick win if the polymer filtration work being conducted at Los Alamos is applicable to these waste streams).

4. ADDITIONAL RESEARCH, DEVELOPMENT, AND TREATABILITY STUDIES AT THE DOE-ORO SITES

In addition to the ongoing technology development activities mentioned above, several other research, development, and treatability study efforts are being conducted through ORO. Many treatability studies and demonstrations have been completed in the past at ORR that are not included in this report. The MWFA would like to get more information on those studies that may be pertinent to the ongoing or planned efforts of the Focus Area.

One demonstration presented to the MWFA is the vitrification of thorium nitrate using a plasma torch. This material, originally manufactured for use in breeder reactors, is currently stored at the Defense national Stockpile Centers in Indiana and Maryland. The plasma torch was designed and developed by the Plasma Torch Corporation, and tested on surrogates at Georgia Tech University. This work has been funded by the Defense Logistics Agency and, depending on its application, could potentially provide the MWFA with an interagency leveraging arrangement. However, the plasma torch system does not have a secondary combustor and, consequently, cannot treat organics. The MWFA needs to investigate and integrate all the plasma-related technology development activities to ensure the ongoing work is cost-effective and meets the needs of the EM-30, 40, and 60 customers.

5. CONCLUSIONS AND RECOMMENDATIONS

The relationship between Oak Ridge and the State of Tennessee environmental agencies appears to be very good. At least one representative from the State accompanied the entire meeting and all tours. This close relationship will assist the MWFA in addressing potential quick wins and other regulatory questions in a much more effective manner.

The MWFA is very grateful for the extensive effort put forth by the DOE and contractor personnel at the ORR facilities to organize this site visit. The presentations given were informative, provided the data that the MWFA was seeking, and offered a fairly comprehensive view of the technology needs and issues facing the DOE-ORO sites. The MWFA sees some opportunities for potential “quick wins” and other near term and long term successes related to the activities at the ORO sites. To enhance these possibilities, the MWFA would like to gather more information related to planned treatability studies and demonstrations at the ORO sites, as previously mentioned. In addition, the Focus Area would like to investigate ongoing and planned treatability studies and capabilities at other sites that could possibly address some of the ORR mixed waste issues.

Once again, the support provided by the ORR personnel is greatly appreciated. The MWFA looks forward to working with and supporting Oak Ridge in meeting its defined priority needs.

APPENDIX A
OAK RIDGE SITE MEETING AGENDA

(OMITTED)

APPENDIX B
LIST OF ATTENDEES

Mixed Waste Focus Area Meeting
Oak Ridge Site Meeting
August 22, 1995

LIST OF ATTENDEES

Name	Organization	Phone	FAX
Jay Roach	LMIT-MWFA	208-526-4974	208-526-1061
David Hutchins	DOE-ORO	615-241-6420	615-576-5333
Michael Torbert	DOE-HQ EM-321	301-903-7109	301-903-7451
Johnny Moore	DOE-ORO	615-576-3536	615-576-5333
Ana Rosado-Gonzalez	DOE-ORO ERD	615-241-4212	615-576-6074
Cavanaugh Mims	DOE-ORO ERD	615-576-9481	615-576-6074
Bob Hightower	LMES Center for Waste Mgmt	615-574-6777	615-576-7500
Jan Berry	LMES Center for Waste Mgmt	615-574-6907	615-576-7865
Terry Sams	LMES ERWM	615-241-2509	615-241-2533
Christine Goddard	LMES ERWM	615-241-4383	615-241-2533
Cindy Kendrick	ORNL STCG	615-241-6584	615-576-5333
Kliss McNeel	LMIT-MWFA	208-526-7925	208-526-1061
Steve Priebe	LMIT-MWFA	208-526-0898	208-526-1061
Gregory Shaia	LMES PGDP WMTS	502-441-5223	502-441-5225
Sladjana Crosley	ORNL Center for Waste Mgmt	615-574-1666	615-574-0740
Les Dole	ORNL ECSA LTD	615-576-4319	615-574-3431
Lance Mezga	LMES ESWMD	615-574-7258	615-576-6222
Ashwin Brahmbhatt	DOE-ORO TDEC	615-481-0097	615-482-1835
Rick Korynta	DOE-ORO WMTD	615-576-9664	615-576-5333
Julie Conner	DOE-ID MWFA	208-526-0648	208-526-5964
Tom Conley	LMES ORNL	615-574-6792	615-576-4195

APPENDIX C
PRESENTATION COVER SHEETS

(OMITTED)

APPENDIX D
OAK RIDGE SITE TECHNOLOGY COORDINATION GROUP MEMBERSHIP

(OMITTED)

OHIO SITE NEEDS TRIP REPORT

OHIO SITE NEEDS TRIP REPORT
July 13 - 14, 1995

1. INTRODUCTION

On July 13 and 14, 1995, representatives from the Mixed Waste Focus Area (MWFA) met with representatives from the Ohio Department of Energy (DOE) sites to ascertain their needs for technology and/or regulatory development for mixed waste. The Ohio sites represented were Fernald and Mound. Battelle Columbus, RMI Titanium, and the West Valley New York site are also under the purview of the DOE Ohio Field Office, but were unable to send representatives to the meeting; however, some input from these sites was provided by Mr. John Murphy of DOE - Ohio Field Office (OFO). The final meeting agenda and list of attendees are included as Appendix A and Appendix B, respectively.

2. EXTENDED AGENDA, RESULTING ACTION ITEMS, AND RECOMMENDATIONS

The first day of the Ohio Site visit the MWFA met with representatives from Fernald and Mound. The majority of time was directed at the planned and ongoing activities at Fernald, because the mixed waste inventory at Fernald represents the bulk of the mixed waste in Ohio. After introductions and a MWFA overview by Julie Conner, DOE-Idaho Operations Office (DOE-ID), presentations on the current and planned technology programs at Fernald were given. During the introductions, Mr. John Sattler DOE-FN indicated that the Fernald Proposed Site Treatment Plan (PSTP) is very accurate, and a good representation of the real situation at the site. In the afternoon, presentations of the specific needs and ongoing and planned treatability studies at Fernald were provided. The second day of the Ohio Site visit included a tour of the Fernald facility in the morning. The afternoon was used for wrap-up and path forward discussions. In addition, an overview of the waste streams and preferred treatment options at the Mound Facility was presented.

2.1 Day One Activities

The MWFA met with DOE and contractor personnel at the Ohio Sites for one full day on July 13, 1995. As previously stated, the bulk of the day was used to discuss the present situation at Fernald.

The Fernald Site is regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). As such, mixed waste treatment units are implemented as CERCLA remediation actions, and permits are not required under the Resource Conservation and Recovery Act. Fernald is currently engaged in decommissioning, decontamination, and site remediation activities, including treatment, as required. The other Ohio sites are continuously working with state officials to get approval for waste from Mound, Battelle, and RMI to be sent to Fernald for treatment. This would eliminate the need for duplicate, small quantity treatment systems at the other sites, which would only be used for small quantities, as well as reduce the costs associated with obtaining RCRA permits for treatment activities at

those sites. The problem is that, as a CERCLA site, Fernald cannot technically accept offsite waste for treatment. Regulatory negotiations are ongoing between DOE and the regulators to resolve this issue.

Fernald presented their ongoing site remediation activities, and indicated where their needs were. Considerable progress has already been made at Fernald to eliminate the mixed waste inventory at the site. By the end of FY95, about two thirds of their waste will have been treated and disposed of at EnviroCare, Nevada Test Site, or the Toxic Substance Control Act (TSCA) incinerator at Oak Ridge. Fernald is using two software packages developed by Pacific Northwest Laboratory (PNL) to aid in their process design work. First is ReOpt, which produces flowsheets based on the contaminants present and the second is RAAS, which performs mass and energy balances. While these are intended primarily for CERCLA applications, the MWFA obtained a contact at PNL and will investigate what benefit they might be to the MWFA.

Fernald has divided the site into five operable units (OUs). Of these, only two, OU1 and OU2 are suspected to have mixed waste.

OU1 consists of the raffinate pits, which primarily contain sludges. Six pits are included in OU1. Some of the pits have been capped and covered with a poly-type liner and other pits are kept under water to stabilize them. Only two of these, Pit 4 and Pit 5, are suspected to be contaminated with RCRA materials. The RCRA constituents are expected to be characteristic materials only, listed constituents are not present in these pits. In fact, the actual presence of any RCRA characteristic materials has not been determined, yet. These areas have been designated as mixed waste because of the*possible* presence of characteristic materials. The sludge in Pits 4 and 5 is expected to meet the waste acceptance criteria (WAC) of the EnviroCare treatment, storage and disposal facility (TSDF) in Utah. The sludges removed from these pits will be dried and sent to EnviroCare for disposition. These pits are regulated under both CERCLA and RCRA. Accordingly, the pits will either be RCRA “clean closed”, or regulatorily accepted as RCRA “clean closed” through the CERCLA process.

OU2 consists of the landfills at Fernald, which contain flyash, lime sludge ponds, and solid waste. Between 3 and 4 million cubic yards of material will be excavated from OU2. Most of this material will be stored in a new disposal cell being constructed at the Fernald Site. This operable unit has not yet been declared as a mixed waste area; however, small amounts of the soil may be contaminated with uranium and, possibly, F-listed constituents. Any excavated material that is contaminated will be treated to meet all applicable RCRA requirements prior to disposition.

The uranium contamination at the Fernald site is due to an incinerator that operated in the past. Uranium in the stack gases was deposited on the surrounding surface soil and, over the years, the uranium has migrated into local water sources and spread beyond the initial deposition area. A plume has resulted from this surface contamination. Fernald is continuously pumping the contaminated water out of the ground, treating it, and returning the clean water to the water table. Much of the water extracted thus far has met all drinking water standards; however, the water has still been treated and returned to the water table. Fernald is investigating a system that allows continuous pumping, treating, and reinjection of the treated water. This method is reportedly 35% more efficient than the present operation.

In general, all remediation activities at Fernald are contracted with private sector vendors. In addition, the ongoing and planned treatability studies are conducted by private sector. Commercially available

technologies required and contracted by Fernald include the following:

- Soil and debris washing
- Acid/ base neutralization
- Cement stabilization
- Macroencapsulation
- Waste water treatment.

The planned remediation activities, schedules, and key decision points are fairly well defined for Fernald. Cover sheets of the presentations given have been included in Appendix C for reference. Complete presentation materials can be obtained from Jay Roach at 208-526-4974. The specific needs identified during these presentations (i.e. treatment, analytical, and regulatory) are discussed in Section 3. The ongoing and planned treatability studies being conducted at the Ohio sites are discussed in Section 4.

2.2 Day Two Activities

On the second day of the visit to the Ohio sites, the MWFA toured the Fernald facility during the morning. Specifically, the pits at OU1, the landfill areas in OU2, and remediation sites were visited. The most critical environmental remediation activity at Fernald is stabilization of the liquid in the K-65 tanks. This waste is planned to be vitrified. An unused tank adjacent to the K-65 tanks is being used to perform field scale studies. In addition, special transportation boxes are being developed for the vitrified material, which will be disposed at the Nevada Test Site (NTS). The development cost of these boxes is about $1million. Utilization of fuel casks for the same purpose has been estimated at $58 million.

The afternoon of the second day was used to discuss action items, define the path forward, and generally close out the meetings. In addition, information was presented by Mound personnel that described the waste and associated needs at that site.

Mound has a little over 100 m^3 of mixed waste. Approximately 90% of their mixed waste falls into the three following categories:

- Scintillation cocktails (43.3 m^3)
- Waste oils (27.4 m^3)
- Miscellaneous solid waste (19.9 m^3)

Treatment has not been definitely identified for these waste streams yet. Additional characterization is required on some of the waste. The specific needs associated with the Mound mixed waste are discussed in Section 3.

2.3 Recommendations by Ohio Personnel to the MWFA

As previously stated, personnel at the Ohio sites feel that the PSTPs for these sites are very representative of the present condition for management of their mixed wastes. Typically speaking, the planned

remediation activities, schedules, and decision points are well defined for the Ohio sites. Work is ongoing and progress is being made. The MWFA team was impressed with the "get the job done" attitude exhibited by the Ohio personnel.

The major area of support that the MWFA may be able to provide to the Ohio sites is in the disposition of small volume, problem waste streams. In addition, the resolution of the regulatory question related to the definition of macroencapsulation, which is currently being pursued by the MWFA, is vital to implementation of the Fernald PSTP. Other than these areas, the Ohio sites are on well-defined remediation courses. Their primary objective is to accomplish these remediation activities on or ahead of the established schedules. Any support that the MWFA can provide to achieve this goal will be gladly accepted. And, the Ohio sites will be glad to support efforts of the MWFA, to the extent that their current remediation activities and schedules are not adversely affected. The MWFA strongly supports the Ohio position, and will strive to help expedite their remediation activities whenever possible.

3. SUMMARY OF OHIO SITE NEEDS

The basic conclusion from the meetings with the Ohio sites is that, as previously stated, Fernald has a well-defined plan for remediation of the site. Very few major needs exist at Fernald, in fact, most of their needs are regulatory, and do not require new technology development activities.

As stated above, a primary need is to get a final regulatorily acceptable definition of macroencapsulation as it relates to disposal at EnviroCare. The MWFA has a task force that is specifically addressing this issue. This effort is attempting to get acceptance of the use of specific types of sealed containers in meeting the requirements for macroencapsulation. An additional related issue dealing with acceptable void volume in the containers will most likely be resolved on a site-by-site basis.

Another "need" of Fernald is treatment of 50 m^3 of "tri-mixed" waste debris. Tri-mixed waste is defined by Fernald as waste that contains RCRA, TSCA, and radioactive constituents. Currently, only liquid feed is acceptable in the TSCA incinerator at Oak Ridge, TN. The TSCA incinerator is planning to install a feed system that will allow solid materials to be incinerated. However, the schedule for completion of this modification is unsure. Consequently, Fernald submitted a Technical Task Plan (TTP) to send this tri-mixed waste to the Argonne National Laboratory - West (ANL-W) facility for treatment in the plasma hearth process (PHP) unit being installed and tested there. This is the only currently identified treatment option for this waste stream. However, potential problems exist related to the timing of the treatment of transuranic (TRU) waste that is planned to be processed in the PHP and treatment of the Fernald trimixed waste. If Fernald's waste is processed after the TRU waste, then the treated Fernald waste would most likely be contaminated with TRU constituents and would not meet the EnviroCare WAC. In addition, the efficiency of PHP in treating polychlorinated biphenyls (PCBs) without generating dioxins in the offgas has not been determined. These questions should be addressed prior to shipping the Fernald waste to Idaho for treatment.

Fernald also identified several analytical needs to make their remediation activities more efficient. Some of these needs are similar to the needs identified at other sites, such as the Savannah River Site and the Idaho National Engineering Laboratory. These characterization needs include:

- development of nondestructive examination/nondestructive assay (NDE/NDA) of drummed waste
- development of a real-time alpha monitor.

In addition, Fernald has a need for development of a radon monitor.

The needs identified for the mixed waste at the Mound facility are generally related to identification of a commercial facility that can treat the three major waste streams at that site, namely, scintillation cocktails, waste oils, and miscellaneous solid waste, which is uncharacterized. The current Land Use Management Plan for the Mound facility calls for the site to be completely remediated and converted into an industrial park by 2004.

For the remaining waste, Mound has identified one primary need and one secondary need. Conceivably both of these could be handled by treatability studies, if suitable demonstrations can be identified.

- Macroencapsulation of lead waste including gloves, lead-acid batteries, and bulk lead (this represents only about 5 m^3, and is similar to the Fernald need)

- Thermal desorption of PCB-contaminated oil from absorbent (one drum).

This information will be considered while the MWFA is collecting data from other Sites about treatment demonstrations and treatability studies that are ongoing and planned throughout the DOE Complex.

4. ADDITIONAL RESEARCH, DEVELOPMENT, AND TREATABILITY STUDIES AT THE OHIO SITES

Three major mixed waste treatability studies are planned or ongoing at Fernald. These include a stabilization treatability study, a chemical treatment treatability study, and a mercury treatment treatability study.

The Stabilization Treatability Study is addressing size reduction, cementation, and chemical stabilization requirements for several waste streams, including grit blast residue, solidified furnace salts, sump cakes, construction rubble, and miscellaneous trash. Thus far, waste loadings have been identified for some of these waste streams, and ammonia emanation studies are ongoing.

The Chemical Treatment Treatability Study is addressing extraction methods/reagents, optimal particle size, and final waste form for several waste streams, including debris, soils/sludges, lead solids, magnesium, barium chlorides, acids/caustics, uranium oxide, and cobalt triflouride. Planned activities include debris washing, solvent extraction, decontamination baths, ”petroset” stabilization, dissolution/precipitation, neutralization, and deactivation using controlled reactions. These activities are scheduled to be completed by September 15, 1995.

The Mercury Treatment Treatability Study is addressing RCRA Land Disposal Restriction compliance, mercury concentrations, and scale-up optimization for several waste streams, including elemental mercury, mercury contaminated debris/water/residue, mercury contaminated salts, florescent light tubes, and

mercury batteries. Planned activities include amalgamation with copper, precipitation, and decontamination.

In addition, Fernald is involved with a study of significant interest to the MWFA. This activity involves a 12-week comparative evaluation for robotic drum inspection systems. Candidates include SWAMI from Savannah River, LMSS from Lockheed Martin Denver, and Aries from SCUREF. The robot systems are intended to examine stored drums for leaks, discoloration, and bulges. This evaluation will most likely be performed at a location that has not been involved in development of one of the robots and that has a relatively stable storage configuration to facilitate the testing.

5. CONCLUSIONS AND RECOMMENDATIONS

The MWFA was very impressed with the positive attitude of the Ohio personnel, their "get the job done" outlook, and their efficient use of the regulatory framework that they must operate within. The Ohio sites do not have many technology development needs for which the MWFA can provide support. However, the visit to Ohio was very informative and will allow the MWFA to facilitate their remediation activities when possible, as well as provide support through development of needed characterization technologies. The support provided by the Ohio personnel to the MWFA was greatly appreciated, and made the visit very successful. The MWFA will assist Fernald, Mound, and the other Ohio sites in achieving their mixed waste management goals in any way that it can.

APPENDIX A
OHIO SITE MEETING AGENDA

(OMITTED)

APPENDIX B
LIST OF ATTENDEES

Mixed Waste Focus Area Meeting
Ohio Site
July 13 - 14, 1995

LIST OF ATTENDEES

Name	Organization	Phone	FAX
Jay Roach	INEL MWFA	208-526-4974	208-526-1061
Dan Dilday	FERMCO	513-648-5807	513-648-5527
Steve Priebe	INEL MWFA	208-526-0898	208-526-1061
Ken Belgrave	FERMCO	513-648-6525	
John Sattler	DOE-FN	513-648-3145	513-648-3076
Dan Kapsch	EG&G Mound	513-865-4207	513-847-5249
Frank Schmaltz	DOE-MB	513-865-3620	513-865-4489
John L. Murphy	DOE-OFO	513-865-3689	513-865-4402
Jonah D. Hodge	DOE-OFO	513-865-3622	513-865-4402
Greg Leigh	FERMCO	513-648-6471	513-648-6913
Dennis N. Cook	FERMCO	513-648-3820	513-648-5527
David E. Ridenour	FERMCO	513-648-6528	513-648-6941
Paul Pettit	FERMCO	513-648-6558	513-648-6913
Rod Warner	DOE-FN (TPO)	513-648-3156	513-648-3076
Don Norman	INEL MWFA	208-526-1679	208-526-1061
Dave Eaton	INEL MWFA	208-526-7002	208-526-1061
Julie Conner	DOE-ID	208-526-0648	208-526-5964

APPENDIX C
PRESENTATION COVER SHEETS

(OMITTED)

ROCKY FLATS NEEDS TRIP REPORT

ROCKY FLATS NEEDS TRIP REPORT
August 29 - 30, 1995

1. INTRODUCTION

On August 29 - 30, 1995, representatives from the Mixed Waste Focus Area (MWFA) met with Department of Energy - Rocky Flats Field Office (DOE-RFFO), Kaiser-Hill, Rocky Mountain Remediation Services (RMRS), and Rocky Flats Citizens Advisory Board (RFCAB) representatives from the Rocky Flats Environmental Technology Site (RFETS) to discuss their needs for mixed waste technology development. Personnel from the MWFA included Richard Kimmel (DOE-Idaho Operations Office), Dave Eaton, Steve Priebe, and Jay Roach. The meeting agenda and list of attendees have been included as Appendix A and Appendix B, respectively.

2. EXTENDED AGENDA, RESULTING ACTION ITEMS, AND RECOMMENDATIONS

The first day of the visit to RFETS consisted of meetings with EM-30, 40, 50, and 60 personnel in which the technology development needs, regulatory status, and ongoing technology development projects were presented to the MWFA. In addition, a demonstration of polymer encapsulation was provided to the Focus Area. The second day included presentations on additional technology development projects, and tours of specific facilities at RFETS and the University of Colorado, with demonstrations of the microwave solidification and super critical carbon dioxide technologies. A presentation was also given on the Federal Facility Compliance Act (FFCA) regulatory commitments for RFETS. In addition, a member from the RFCAB made a presentation discussing a stakeholder's perspective of the technology development and waste treatment activities ongoing at RFETS, and throughout the DOE complex.

2.1 Day One Activities

On day one of the MWFA visit to RFETS, the technology development needs for EM-30, 40, and 60 were presented. In addition, presentations were given on the status of the polymer encapsulation and low temperature thermal desorption (LTTD) technology development projects, with demonstrations of polymer macro- and microencapsulation. Cover sheets for presentations have been included in Appendix C for reference. For complete copies or more information concerning these presentations, please contact Jay Roach at 208-526-4974.

Rocky Flats currently has about 14,000 m^3 of mixed low-level waste and 600 m^3 of mixed transuranic (TRU) waste. The majority of RFETS waste is comprised of wastewaters, sludges, and salts. Through development of the Comprehensive Treatment Management Plan (CTMP) with the State of Colorado, treatment options have been identified for virtually all of the mixed waste inventory at RFETS. Two of these technologies, low temperature thermal desorption (LTTD) and microwave solidification, were selected by the Western Governors Association (WGA) Development of Onsite Innovative Technologies

(DOIT) committee for demonstrations. Most of the identified technologies apply to both mixed low-level wastes and mixed TRU wastes. However, not all of these options are currently available. With few exceptions, RFETS' technology development needs consist of demonstrating technologies at a sufficient scale to bridge the gap between classical technology development and commercial implementation.

The CTMP defines several mixed waste treatment systems, which address 95% of the RFETS mixed waste inventory. This includes mixed TRU wastes, but excludes noncompliant saltcrete, pondcrete, and pond sludge. These wastes will be addressed by the Environmental Restoration EM-40 program. The basic systems are identified as System 5, System 3, and System 2/4B.

System 5 is a surface organic contaminant removal system that incorporates the following processes:

Pretreatment:	liquid chemical extraction (LCE) for cyanide removal; mercury separation
Primary Treatment:	surface organic removal using LTTD using super critical carbon dioxide extraction (SCDE) (mercury-containing residuals will be polymer microencapsulated in System 3)
Post Treatment:	catalytic chemical oxidation (Delphi Detox^{SM}) for organic destruction.

System 3 is an immobilization system intended for miscellaneous wastes that incorporates the following capabilities:

Pretreatment:	sorting, size reduction, chemical pretreatment
Primary Treatment:	cementation, polymer macroencapsulation, and polymer microencapsulation based on the original waste form [i.e. Resource Conservation and Recovery Act (RCRA) debris rule]
Post Treatment:	offgas treatment; solidified waste to storage or disposal

System 2/4B is a sludge immobilization system that includes the following processes:

Pretreatment:	sorting, size reduction, chemical pretreatment
Primary Treatment:	microwave solidification (cementation and polymer solidification have also been identified as acceptable options for this technology)
Post Treatment:	offgas treatment; solidified waste to storage or disposal.

One significant modification to the original CTMP was the indefinite deferral of System 1A, a thermal destruction process using the Fluidized Bed Unit (FBU) incinerator. This system was deferred because the current regulatory environment in Colorado is such that successful permitting of an incinerator has very low probability.

The technologies included in the preceding systems have been reviewed by the State of Colorado for use in treating RFETS mixed wastes. Major modification of these plans would require significant renegotiation of the existing strategy with the state. Out-of-state treatment is a potential alternative included in the CTMP. Colorado state regulators are extremely reluctant to allow offsite mixed wastes to be treated at RFETS; however, the regulators will allow treatability studies of offsite waste to be conducted at RFETS. The EM-30 representative identified specific technology development needs associated with the processes that make up these three treatment systems. These needs are included in Section 3. The MWFA must

work with RFETS personnel to determine the scope of work required to get these technologies to the point of implementation.

The EM-40 needs were also presented to the MWFA. Several sites at RFETS have been identified for remediation. These include burial trenches, solar pond sludges, surficial soil (Plutonium and Americium contamination levels are expected up to 1000 pCi/gram), subsurface soils, and investigation derived waste (IDW). Some question exists concerning which Focus Area will have purview over each of these waste streams. The surficial soil and IDW will most likely fall within the scope of the MWFA; however, the soils are expected to have little RCRA regulated contamination. The other ER efforts will probably be addressed by the Landfill Stabilization and Plumes Focus Areas. However, one of the trenches is known to have approximately 100 drums of depleted uranium chips that will most likely fall within the purview of the MWFA.

The most serious issue at RFETS is the 106 metric tons of high Plutonium content residues, which are under the purview of EM-60. These materials typically range between 1% and 30% Plutonium, with an average of about 3% Plutonium. The residues are mixed wastes; however, since this material is regulated under Compliance Order 93-04-23-01, these waste streams are not included in the Proposed Site Treatment Plan. Most of the technologies specified for mixed low-level wastes and mixed TRU wastes are applicable to residues, but, because of the potential criticality issues associated with these waste streams, the planned treatment units for the residues are typically smaller. The microwave solidification technology has been partially supported by EM-60 because of its potential applicability to residues. The technology development needs associated with this process, as well as other needs identified by EM-60, are listed in Section 3, below.

After the EM-30, 40, and 60 needs were presented to the MWFA, two ongoing technology development activities were discussed, LTTD and polymer solidification. In addition, the polymer encapsulation process was demonstrated. The LTTD (Rust Federal Services VacTrax™) process is analogous to a clothes dryer that boils off organics, while operating under a vacuum to facilitate removal of the contaminants. The current plan is to attach a non-thermal plasma (NTP) unit on the offgas system to oxidize organic vapors (i.e. dioxins, furans) driven off by the LTTD process. This technology, also referred to as silent discharge plasma, was developed at Los Alamos National Laboratory. A treatability study will be conducted using waste absorbent with Plutonium contamination between 75 and 80 nCi/gram. This waste stream is considered to represent the worst case for the waste identified for treatment in the LTTD process. In addition, the NTP has been shown to be verifiably effective in dioxin/furan destruction down to 10 ppm.

The polymer solidification development project includes macroencapsulation and microencapsulation. Salts, sludges, ash, and ground glass are amenable to microencapsulation, while lead shielding, combustible debris, filters, metal debris, glass, and beryllium-contaminated debris are amenable to macroencapsulation. Testing of thermoplastic polymers, thermoset polymers, and epoxy resins for various applications is ongoing, including low exotherm (i.e. $< 120^{\circ}C$) polymers for macroencapsulation of semivolatile organic compounds from the LTTD process. In addition, a prototype Fourier Transform Infrared (FTIR) Spectroscopy probe developed by Ames Laboratory that measures the waste/polymer ratio in a waste/polymer co-extrusion process has been tested, modified, and successfully demonstrated on the microencapsulation process at RFETS.

Specific technology development needs associated with the LTTD and polymer solidification processes are discussed in Section 3. As previously stated, the MWFA must work with RFETS personnel to determine the scope of work required to get these technologies to the point of implementation.

2.2 Day Two Activities

On the morning of the second day of the MWFA visit to RFETS the status of the regulatory commitments associated with the FFCA was discussed. This presentation highlighted the maturity of the near term and long term strategy developed by RFETS, in conjunction with State of Colorado regulators, relative to the DOE complex. The MWFA recognizes this, and will support the RFETS commitments through technology development projects, where appropriate.

A very interesting presentation was given by a stakeholder from the RFCAB. The ideas discussed by this stakeholder were intriguing and encouraging. However, as stressed by the presenter, these were the opinions of just one stakeholder. Consequently, the thoughts expressed in this presentation probably do not belong in this report. Although, one especially interesting point deserves comment. The impression of this stakeholder, which was intimated to be true of other stakeholders, was that the technologies being developed and implemented by DOE for treatment of mixed wastes seem "low-tech", and the stakeholders would like to see more innovative technologies pursued by DOE. One technology specifically mentioned was bioremediation.

After this, the Alternatives to Incineration efforts were discussed. Specifically, the two technologies involved with this project are catalytic chemical oxidation and liquid chemical extraction. The LCE process is relatively mature. However, the CCO technology, which uses Fe(III) as the main oxidizer in the presence of hydrochloric acid and chloride solution (at 200°C and 100 psi) to destroy wastes, has only been demonstrated on a bench scale level. The current funded scale-up is 260:1. Concerns have been discussed regarding a scale-up of this magnitude. For RFETS residues, the bench scale unit would be considered full scale.

The remainder of the second day was used for demonstrations of the microwave solidification and SCDE processes. The microwave solidification process uses microwave energy at 60 kW, 915 MHZ, to heat and vitrify mixed wastes (a smaller 6kW system will be used to solidify residues). The sludge waste feed is initially dried by passing the material through a cavity where it is exposed to low intensity microwave energy. The material is then fed into the melter where the waste is vitrified to a final waste form that passes Toxicity Characteristic Leaching Procedure (TCLP) requirements. One advantage that the microwave solidifier has over joule heated melters is that it does not use a refractory, which reduces residual waste and potential worker exposure during refractory changeout.

The SCDE demonstration was conducted at the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado at Boulder. The SCDE process accomplishes removal of organic compounds by "washing" the waste in supercritical CO_2 (1500 psi, 60°C). In addition, the CO_2 can be operated in the liquid phase (900 psi, 60°C) and still effectively remove organics. Based on debris washing standards established by RCRA, this latter process may have certain regulatory benefits. In addition, if the SCDE process is used for large volume treatment applications, the CO_2 could be effectively reheated and recycled.

The technology development needs associated with these demonstrations, including CCO, LCE, microwave solidification, and SCDE, must be jointly defined between RFETS and the MWFA to ensure that established regulatory commitments are not adversely affected, and that the MWFA resources are used as cost-effectively as possible.

2.3 Recommendations by Rocky Flats Personnel to the MWFA

Based on the meetings with RFETS personnel, two basic recommendations have been provided to the MWFA:

1. The coordination between the five Focus Areas seems weak. Better integration, responsibility delegation, and crosscutting program coordination between Focus Areas must be fully developed to ensure that the needs of the DOE Complex are being met.

2. The MWFA should involve the sites much earlier in the Technical Task Plan (TTP) evaluation and selection process in the future. The current TTP guidance from the MWFA was not clearly communicated to RFETS, which caused confusion for Principle Investigators who must develop longform TTPs. The areas of confusion have been addressed by the MWFA for the current process. Future TTP submittals will be based on directed calls, and the MWFA plans to involve the sites through the Waste Type Managers as soon as possible in the process.

2.4 Resulting Action Items

Two major action items resulted from the MWFA visit to RFETS. The actions are as follows:

1. The MWFA needs to clarify the scope of TTPs that have been modified by the MWFA from the submitted scope of work. The specific TTPs to address include Polymer Encapsulation RF15MW49, Low Temperature Thermal Desorption RF15MW34, and Super Critical Carbon Dioxide Extraction RF15MW59.

2. The MWFA needs to further address unfunded TTPs that support technologies that are integral to the existing regulatory commitments to the State of Colorado. The specific TTPs are Alternatives to Incineration RF152004 and Microwave Solidification RF152009.

Based on conversations with RFETS personnel, both of these action items have been addressed and the requested information has been submitted in letters to Russell McCallister DOE-RFFO from William Owca DOE-ID (OPE/MWFA-95-0076, OPE/MWFA-95-081). If further information is required concerning these action items, please contact Jay Roach at 208-526-4974 or Dave Eaton at 208-526-7002.

3. SUMMARY OF ROCKY FLATS SITE NEEDS

As previously stated, the technologies that comprise the three major RFETS treatment systems have

specific technology needs, as identified by EM-30, 40, and 60 personnel at the site. Listed below are the identified technologies associated with the treatment systems and the development needs as indicated by RFETS personnel.

1. Polymer encapsulation - Radioactive tests need to be performed on several RFETS wastes to determine polymer-radioactivity interactions and to determine Land Disposal Restriction (LDR) compliance at various waste loadings.

2. Microwave vitrification - The state of Colorado has requested a better characterization of the offgas from the microwave system. RFETS also feels that improved feed handling and final product removal systems are required for low-level and TRU mixed wastes, as well as further treatability studies on other waste streams, particularly residues.

3. Catalytic chemical oxidation (Delphi Detox) - Although directed to work with Morgantown Energy Technology Center (METC), Savannah River (SRS), and Weldon Springs (WS) to obtain needed data from the 260 gal reactor to be tested at SRS and WS, RFETS has some questions as to whether these tests will address their concerns. This is particularly true for Pu-containing wastes.

4. Low temperature thermal desorption - RFETS needs to continue the CRADA with Rust to develop the VacTrax system in conjunction with nonthermal plasma for use with actual RFETS waste.

5. Supercritical CO_2 extraction - Install a SCDE system for testing on actual RFETS wastes. Investigate the potential for removal of heavy metals through complexation with chelating agents. In addition, the capabilities of carbon dioxide in liquid phase needs to be further investigated.

6. Liquid chemical extraction - Methods to separate washing solutions from particulate waste need to be evaluated, and a radioactive demonstration should be conducted (this technology may provide cyanide treatment capabilities needed at other site in the DOE complex).

Some additional needs identified during the MWFA visit to RFETS include treatment of residues with reactive metals and drummed depleted uranium chips. These needs may be addressed by the reactive metals and uranium chips mobile treatment units being developed by the Albuquerque Operations Office.

4. ADDITIONAL RESEARCH, DEVELOPMENT, AND TREATABILITY STUDIES AT THE ROCKY FLATS SITE

The MWFA was briefed on many treatability studies that have been or are planned to be conducted at RFETS. A brief description of these is included below.

1. RFETS would like to conduct a treatability study on a non-organic sludge waste in the mixed residue waste inventory using the bench-scale microwave solidification unit. Only one drum of this waste stream exists at RFETS, and completion of the treatability study, which is scheduled for the first quarter of FY1998, would eliminate the waste stream entirely.

2. An electrochemical chlorination system tested at RFETS under a treatability study exemption successfully destroyed cyanides in 150 gallons of spent plating bath waste and excess chemical cyanide solutions. The success of this study has provided necessary data to support a pending Part B permit modification from the Colorado Department of Public Health and the Environment (CDPHE) to treat the remainder of the cyanide contaminated waste in inventory. This technology could potentially treat the cyanide wastes in the DOE Complex, also.

3. Rocky Flats has demonstrated reactive (peroxide forming) chemical destruction using ultraviolet oxidation. Three liters of waste were destroyed during a treatability study. This system is now implemented and awaiting an operating permit from CDPHE. Expedited development of a non-thermal treatment process for this relatively low volume waste stream was specifically requested by CDPHE. The system could treat a substantial portion of the reactive chemical wastes in inventory at RFETS.

4. Removal of mercury from contaminated waste using a thermal retorting technology was demonstrated at RFETS under treatability study exemption provisions. Six kilograms of spent fluorescent lamps have been treated and can now be disposed without further treatment. This system could help eliminate the crushed glass mixed waste streams at RFETS and in the Complex.

5. Extensive testing has been accomplished with the polymer encapsulation technologies being developed at RFETS. Over 20 different surrogate wastes have been tested and successfully met RCRA LDR regulations (Universal Treatment Standards and Debris Rule Standards). In addition, nearly 600 gallons of actual low-level mixed wastes have been successfully encapsulated in polymer under treatability study exemptions. Rocky Flats and Envirocare of Utah are negotiating waste acceptance criteria to allow disposal of the encapsulated waste at Envirocare. Ames Laboratory and the Colorado School of Mines are also partners in this effort. In addition, negotiations with a commercial partner are currently in process. The macroencapsulation technology could potentially eliminate up to seven waste streams in FY1996 under a Research, Development, and Demonstration (RD&D) permit.

6. Bench-scale testing of the Delphi Detox™ (catalytic chemical oxidation) system with 16 different surrogate waste streams has demonstrated that this technology can process all RFETS liquid and solid combustible mixed wastes. This incineration alternative could potentially treat a significant volume of mixed waste at Rocky Flats.

7. The RFETS LTTD project will contract the Clemson Technical Center to perform a treatability study on “used absorbent” samples using the Rust VacTrax unit. If the testing and treatment is successful, the waste will be eliminated from the Rocky Flats low-level mixed waste inventory.

Specific research and development (R&D) activities outside of the scope of the discussions during the site visit were not identified. However, if RFETS personnel are aware of past, ongoing, or planned treatability studies or R&D projects that appear to be related to the mission of the MWFA, information concerning these activities would be appreciated.

5. CONCLUSIONS AND RECOMMENDATIONS

The MWFA is very grateful for the extensive effort put forth by the DOE and contractor personnel at the RFETS facility to organize this site visit. The presentations given were informative, provided the data that the MWFA was seeking, and offered a fairly comprehensive view of the technology needs and issues facing the Rocky Flats site. The MWFA recognizes the challenge in meeting the needs of the sites, but sees opportunities for potential "quick wins" and other near term and long term successes related to the activities at the RFETS. To enhance these possibilities, the MWFA would like to gather more information related to planned treatability studies and demonstrations at the RFETS, as previously mentioned. In addition, the Focus Area would like to investigate ongoing and planned treatability studies and capabilities at other sites that could possibly address some of the RFETS mixed waste issues. Once again, the support provided by the RFETS personnel is greatly appreciated. The MWFA looks forward to working with and supporting Rocky Flats in meeting its defined priority needs.

APPENDIX A
ROCKY FLATS SITE MEETING AGENDA

(OMITTED)

APPENDIX B
LIST OF ATTENDEES

Mixed Waste Focus Area Meeting
Rocky Flats Site Meeting
August 29, 1995

LIST OF ATTENDEES

Name	Organization	Phone	FAX
Scott Grace	DOE Environmental Restoration	303-966-7199	303-966-7447
Dick Bateman	Kaiser-Hill Technology Integration	303-966-5746	
Cliff Brown	ORNL/RFFO	303-966-3667	303-966-4773
Andrea Faucette	Kaiser-Hill Technology Integration	303-966-6420	303-966-7925
Charles Brown	Kaiser-Hill Technology Integration	303-966-5277	303-966-5305
Jake Jakubowski	Kaiser-Hill SMM&I	303-966-3533	303-966-5535
Peter Montez	Kaiser-Hill Technology Integration	303-966-7681	303-966-5305
Joe Lucerna	Kaiser-Hill Technology Integration	303-966-7229	303-966-5305
Greg Sprenger	Kaiser-Hill Technology Integration	303-966-3159	303-966-7096
Jeff Petersell	Kaiser-Hill Technology Integration	303-966-4724	303-966-5305
Dave Phillips	Kaiser-Hill Technology Integration	303-966-7104	303-966-5305
Steven Barela	Kaiser-Hill Technology Partnerships	303-966-2085	303-966-4845
Russell McCallister	DOE-RFFO OWM	303-966-9692	303-966-2256
Gary Semones	Kaiser-Hill Technology Integration	303-966-3044	303-966-7925
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David Eaton	LMIT MWFA	208-526-7002	208-526-1061
Richard Kimmel	DOE-ID MWFA	208-526-5583	208-526-1184
Jay Roach	LMIT MWFA	208-526-4974	208-526-1061
Steve Priebe	LMIT MWFA	208-526-0898	208-526-1061
Mike Miller	BDM EM-35	301-601-5387	301-601-5426
Tom DuPont	RFCAB	303-989-8040	
Tim McKeown	RMRS LDR Programs	303-966-9642	303-966-3578
Kathleen Cummings	Kaiser-Hill Technology Partnerships	303-966-5413	

APPENDIX C
PRESENTATION COVER SHEETS

(OMITTED)

SAVANNAH RIVER SITE NEEDS
TRIP REPORT

SAVANNAH RIVER SITE NEEDS TRIP REPORT June 7 - 9, 1995

1. INTRODUCTION

Mixed Waste Focus Area (MWFA) personnel met with Savannah River Site (SRS) DOE and Westinghouse staff from June 7-9, 1995, to discuss the strategy for future development of waste treatment technologies and the particular requirements that must be met to support their programs. DOE-ID personnel included Chris Bonzon and Richard Kimmel. Lockheed Martin Idaho Technologies (LMIT) personnel included Dave Eaton, Dirk Gombert, Don Norman, Steve Priebe and Jay Roach. The final meeting agenda is attached, along with a list of attendees from the meetings.

2. EXTENDED AGENDA, RESULTING ACTION ITEMS, AND SUGGESTIONS

The first day of the SRS visit consisted of meetings with SRS EM-30/40/50 personnel to help the MWFA better understand the SRS technology needs. The second day included site tours, and about two hours of open question-answer time to further develop mutual understanding. On the third day, some of the MWFA representatives visited the Clemson University Research Center.

2.1 Day One Activities

The first day of the visit was very productive, with presentations by both SRS and MWFA personnel, and discussions of SRS needs and technology evaluations. The SRS attendees were well informed, prepared, and very supportive of collaborative research. The action items listed below resulted from the meetings. Jay Roach will be responsible for following up on these action items.

2.1.1. SRS personnel will review the list of EM-30/50 funded research provided by the MWFA, and transmit a list of activities in which they have a particular interest, including details on the data they need from the activities and point-of-contact following the research. Jay Roach will provide a copy of the DOE EM-30 document, *Preliminary Compilation of Office of Waste Management Mixed Waste Technology Development Activities, December 1994*, to SRS to support this action.

Status: Documents transmitted to SRS on July 10, 1995

2.1.2. SRS personnel will transmit available reports on SRS treatability studies for MWFA review.

Status: Some data has been received, but the MWFA would like to get more information on these types of activities, including waste streams treated, partnerships involved, etc. Please provide contact names from which this data can be obtained.

2.1.3. SRS personnel will transmit topical and quarterly reports to keep the MWFA current on their EM-30 funded research. Initially, this will include the plan for testing Delphi Detox™ technology, and the reports on wet chemical oxidation and polychlorinated biphenyl (PCB) treatment.

Status: Information received as requested

2.1.4. The program and test plans for the SRS continuous emission monitors evaluation project will be transmitted to the MWFA.

Status: Information received as requested

2.1.5. Don Norman (MWFA) and Dick Shank (SRS) will collaboratively develop a list of waste treatment requirements independent of specific technology development.

Status: In progress

2.2 Day Two Activities

The second day of the visit, MWFA personnel toured several SRS facilities, including the Defense Waste Processing Facility (DWPF), the Consolidated Incinerator Facility (CIF), radioactive waste burial ground, and the TNX Facility. Construction of the DWPF and the CIF are nearing completion. The CIF will require significant pre-sorting of waste to meet the feed limit of 21 inch boxes.

2.3 Day Three Activities

The third day, MWFA personnel, including Dirk Gombert, Don Norman, Steve Priebe, and Jay Roach, visited the Clemson University Research Center to hear presentations by Principle Investigators (PIs) and tour the vitrification test facilities. Clemson currently operates three melter systems, including the laboratory-scale EnVitCo joule-heated melter, the Stir Melter stirred melter, and the Electro-Pyrolysis DC arc melter.

2.4 Suggestions by SRS Personnel to the MWFA

The SRS staff also had the following suggestions for the focus area:

2.4.1. The MWFA should collaborate with the National Programs such as those for low-level and transuranic (TRU) wastes, as well as the other focus areas. Funding for research, policy making, and general strategy should be kept as consistent as possible.

2.4.2. Leaders for the MWFA waste category integrated product teams should have an EM-30 orientation and, to the extent possible, research proposals should be evaluated for their potential to address the criteria developed from the site visits.

2.4.3. Paperwork demands on the PIs should be kept to a minimum. Only reporting deemed absolutely necessary should be required.

2.4.4. Funding support should be kept consistent to keep research active through the life-cycle of the project. The MWFA emphasized that PIs should expect to have decision points built into their programs that could be used to evaluate progress, to determine future funding.

2.4.5. Solutions developed by individual sites for unique or unusual waste streams should be consolidated into a single source such as a notebook or the Internet that could be made available to other sites. This will allow cross-fertilization of ideas throughout the complex. This pertains also to sharing of documents such as Environmental Impact Statements and waste certification programs.

2.4.6. A lack of consistency is prevalent among various DOE databases for waste generation. The repeated calls for updates on different databases is somewhat onerous to the sites. This is more of an EM-30/40 problem than a MWFA problem, but input by the MWFA might help the situation.

2.4.7. Sites should coordinate the development of data quality objectives for tests of new technology to ensure that the data obtained has the maximum usefulness to the most sites.

3. SUMMARY OF SAVANNAH RIVER SITE NEEDS

Savannah River Site has recently completed a site needs assessment. However, it was oriented toward treatment technoogies for specific waste streams. Further discussions between the MWFA and SRS elicited other needs in areas such as monitoring and characterization.

3.1 General Needs at SRS

In general, the SRS needs are very similar to those of the Idaho National Engineering Laboratory (INEL); both sites have a significant amount of mixed-TRU contaminated debris that will probably require a thermal treatment process. At SRS, the mixed-TRU contaminated material is generally equipment contaminated with Plutonium-238 (Pu^{238}) (and some Pu^{239})and Resource Conservation and Recovery Act (RCRA) constituents. The extensive Pu^{238} contamination is the primary concern for the SRS and adds complexity to addressing their mixed waste needs. For this reason, SRS personnel are interested in a hybrid plasma melter, which combines a Russian plasma unit with an induction melter rather than the fixed-hearth plasma process or joule-heated melters currently supported by the MWFA, and the rotary-hearth plasma and DC arc technologies currently supported by the Landfill Focus Area. The hybrid unit is favored because it is not refractory lined, which may reduce the potential for the spread of Pu^{238} and Pu^{239} contamination that can occur during refractory removal and replacement.

The SRS expects to submit a Technical Task Plan (TTP) proposing an experimental plan for the Russian melter. The current strategy at SRS allows a three year window for completion of a radioactive demonstration of this technology. The "kick-and-roll" (processing whole drums without extensive characterization) potential for Plasma Hearth Process (PHP) is very attractive for SRS, but they are holding judgment until more performance data is available.

Alternate non-thermal treatment, debris washing, and stabilization technologies similar to those currently funded are also needed. A demonstration of the Delphi Detox™ system is planned at SRS, but the non-thermal technology of primary interest is wet chemical oxidation developed at SRS. The Delphi project is planned because it is currently funded, but the SRS does not consider it applicable to their wastes. Debris washing is required to decontaminate mixed-TRU contaminated equipment. The SRS also plans to submit a proposal to develop a concept for stabilizing contaminated soils in the SRS high-level-waste tanks after the tanks are decommissioned. This strategy has also been proposed at the INEL, and if funded, this work should be conducted collaboratively between the sites.

3.2 Specific Needs at SRS

A number of specific individual needs were identified by SRS personnel:

3.2.1. Much of the SRS mixed-TRU waste is contaminated with Pu^{238} at levels 10 to 100 times greater than that allowed in TRUPACT II containers. Meeting the shipping limits requires blending this material with other materials/wastes to dilute the plutonium, which generated huge waste volumes for shipping to Waste Isolation Pilot Plant (WIPP). Efforts need to be directed toward development of an approved stabilization/packaging process that does not require dilution to meet shipping limits. In addition, the possibility of changing the regulations governing TRUPACT II containers should be pursued.

3.2.1.1. Organic contamination must be removed/destroyed to eliminate hydrogen generation.

3.2.1.2. Stabilization requirements may require refinement because the Toxicity Characteristic Leaching Procedure (TCLP) was clearly not designed for these wastes. Stabilization is also needed to place the Pu^{238} TRU waste in a safe form for site storage.

3.2.1.3. Macroencapsulation requirements are perceived as a problem at SRS, and their personnel requested assistance in setting a common strategy.

Action: Paul Grahovac of the MWFA has formed a working group to resolve this problem.

3.2.1.4. TRU contaminated debris (PPE, rubber, swipes, rags, glassware, metal objects, equipment, wood, plastic, etc.) and resins (no sludges) containing Pu^{238} must be treated to meet WIPP Waste Acceptance Criteria (WAC), TRUPACT II requirements, and possible Land Disposal Restrictions (LDRs). This includes remote sorting, decontamination, and volume reduction.

3.2.2. Due to the demand on resources and lack of laboratory support available to do waste characterization by traditional means, additional work on nondestructive assay/nondestructive examination (NDA/NDE) is needed.

3.2.2.1. Tritium in porous media and uranium in clays should be characterized.

3.2.2.2. Isotopic distribution in wastes should be determined without direct sampling.

3.2.2.3. Alpha-emitting radionuclide content in waste should be determined without sampling to ensure that waste going to CIF has less than 58 nCi/g and that shipped waste has less than 100 nCi/g. The 58 nCi/g limit results from the expected volume reduction in the CIF and the need to produce a final waste form that contains less than 100 nCi/g of alpha-emitting radionuclides.

3.2.2.4. Free liquids, volatile organic compounds (VOCs), H_2, and methane should be characterized without direct sampling.

3.2.3. PCBs must be destroyed and organic sludges containing heavy metals must be immobilized to meet RCRA LDRs.

3.2.4. Soil sorting and immobilization is required for organic, metal, and radioactive contaminants, including tritium.

3.2.5. Amalgamation of mercury in the presence of specific contaminants should be demonstrated.

4. ADDITIONAL RESEARCH, DEVELOPMENT, AND TREATABILITY STUDIES AT SRS

4.1 Near Term Implementation Possibilities

During the meetings, several potential opportunities at SRS for rapid implementation of technologies were identified. Nine drums of PCB wastes are to be processed by Rust Federal Services. The MWFA could possibly facilitate shipping other similar wastes for treatment, thereby eliminating waste streams from the inventory. SRS also has two drums of elemental calcium which might be eliminated in a treatability study. The SRS wants to ship contaminated lead to Envirocare, Inc. for macroencapsulation and disposal, but requires some financial support to initiate a contract. The SRS also has a functional CO_2 blasting surface decontamination system that could possibly be used by others or copied for use elsewhere.

4.2 Complex-wide Integration Possibilities

Other work now underway may also be useful at other sites, and should be integrated with similar efforts funded elsewhere. Ongoing and planned activities include the following:

4.2.1. SRS intends to use a building within the TNX Facility, which was originally used to construct and test a prototype of the CIF off-gas system, to test other off-gas system components in the future.

Comment: This work should be coordinated with the off-gas system studies at MSE, Inc.

4.2.2. Of significant interest to the MWFA is a project in which SRS will use the EPA test center in Arkansas to test at least seven different continuous emissions monitoring (CEM) systems to compare their operations and effectiveness.

Comment: This work should be integrated with the Oak Ridge proposals to use the Toxic Substance Control Act (TSCA) incinerator as a test bed for CEMs.

4.2.3. Work is near completion using vinyl-ester resins for stabilization and encapsulation.

Comment: This work should be integrated with the polyethylene results from Rocky Flats and Brookhaven, as well as the ongoing efforts at the INEL.

4.2.4. A TRU vent-and-purge device is to be demonstrated at SRS by mid-July, which may be useful for drummed storage at many sites.

4.2.5. Current work on surface acoustic wave and nondestructive assay techniques must be coordinated with work underway throughout the complex.

5. CONCLUSION

The MWFA visit to SRS was very successful. The purpose of the trip, to identify and understand the SRS mixed technology development needs and status, was achieved to a level beyond the MWFA expectations. The preparation and support by the SRS DOE and contractor personnel made this trip a success, and was greatly appreciated. The MWFA looks forward to working with SRS in the future.

APPENDIX A
SAVANNAH RIVER SITE MEETING AGENDA

(OMITTED)

APPENDIX B
LIST OF ATTENDEES

Mixed Waste Focus Area
Savannah River Site
June 7 - 9, 1995

LIST OF ATTENDEES

Name	Organization	Phone	Fax
Jim Brown	DOE-SR Landfill Focus Area	803-725-2760	803-725-3616
Howard Pope	DOE-SR MWFA	803-725-5544	803-725-1440
Chris Bonzon	DOE-ID MWFA	208-526-3752	208-526-1184
Richard Kimmel	DOE-ID MWFA	208-526-5583	208-526-1184
Lou Papouchado	WSRC-SRTC	803-725-3701	803-725-1660
Harold Sturm	WSRC-SRTC	803-725-3497	803-725-8136
David Eaton	INEL MWFA	208-526-7002	208-526-1061
Steve Priebe	INEL MWFA	208-526-0898	208-526-1061
Dirk Gombert	INEL MWFA	208-526-4624	208-526-1061
Donnie Helton	WSRC-SRTC	803-725-8183	803-285-8136
Don Norman	INEL MWFA	208-526-1679	208-526-1061
Jim Wright	DOE-SR	803-725-5608	803-725-3616
Allison Blackmon	DOE-SR	803-725-9762	803-725-3616
Dick Shank	WSRC SW&RE	803-644-4912	803-644-4916
Kim Wierzbicki	WSRC SW&RE	803-952-5817	803-952-5183
Jim Blankenhorn	WSRC SWE	803-952-3722	803-952-4405
Cynthia Beaumier	WSRC SWE	803-952-4175	803-952-4405
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Stan Massingill	DOE-SR SWD	803-725-3974	803-725-1440
Brent Daugherty	WSRC SWE	803-557-6304	803-557-6306
Jay Roach	INEL MWFA	208-526-4974	208-526-1061